ARCHAEOLOGICAL INVESTIGATIONS AT SITE 45-DO-204, CHIEF JOSEPH DAM PROJECT, WASHINGTON

by

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The technical findings and conclusions in this report do not necessarily reflect the views or concurrence of the sponsoring agency.

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ABSTRACT

Site 45-DO-204 is on the south bank of the Columbia River (River Mile 567) atop a narrow alluvial fan opposite the mouth of the Omak Trench. Tucked into a small cove, the site location offered a secluded, protected campsite less than .4 km from Parson's Rapids. Vegetation is characteristic of the Upper Sonoran life zone. The University of Washington excavated 153.8 m (5.5 %) of site volume in 1978 for the U.S. Army Corps of Engineers, Seattle District, as part of a mitigation program associated with adding 10 ft to the operating pool level behind Chief Joseph Dam. A nested, stratified sampling design of randomly placed and purposively selected 1 x 1-m excavation units arranged in 1 x 2-m and 2 x 2-m cells disclosed at least four prehistoric occupations spanning the last 4500 years. The earliest occupation, sparsely represented by a triangular projectile point preform and chalcedony blade, some debitage and fire-modified rock, probably dates to before 4500 B.P. The second occupation is marked by a variety of functional tool forms and a small firepit with pine cones and pine seeds radiocarbon dated to 4590±143 B.P. The third occupation, defined as a living surface radiocarbon dated to 2812±344 B.P., contains the densest concentration of artifacts found at the site. The most recent occupation is distinguished by a stratified earth oven, radiocarbon dated at 592±71 B.P. and 655±67 B.P. A dense bone scatter, several firepits, and an earth oven indicate short-term activities. Tools document an emphasis in all four periods on hunting and butchering, supplemented by the gathering and processing of plant stuffs.

TABLE OF CONTENTS

ABSTRACT iii

TABLE OF CONTENTS v

LIST OF FIGURES vii

LIST OF TABLES ix

LIST OF PLATES xi

PREFACE xiii

ACKNOWLEDGEMENTS xv

1. INTRODUCTION 1

INVESTIGATIONS AT 45-DO-204 5
REPORT FORMAT 7

2. NATURAL AND CULTURAL STRATIGRAPHY 9
Sarah K. Campbell, S. Neal Crozier and Ernest S. Lohse

GEOLOGIC SETTING 9
PROCEDURES 11
COLUMN SAMPLE DESCRIPTIONS 13
DEPOSITIONAL HISTORY 14
DEPOSITIONAL UNIT I--Columbia River Gravels 18
DEPOSITIONAL UNIT II--Alluvial Fan 18
DEPOSITIONAL UNIT III--Coarse Sands 20
DEPOSITIONAL UNIT IV 22
DEPOSITIONAL UNIT V 22
ANALYTIC ZONES 22
ZONE 4 22
ZONE 3 25
ZONE 2 25
ZONE 1 25
SUMMARY 25

3. ARTIFACT ANALYSIS 29
Ernest S. Lohse

TECHNOLOGICAL ANALYSIS 30
FUNCTIONAL ANALYSIS 42
STYLISTIC ANALYSIS 70

4. **FAUNAL ANALYSIS** 85
Stephanie Livingston

FAUNAL ASSEMBLAGE 85
SPECIES LIST 85
DISCUSSION 88

5. **BOTANICAL ANALYSIS** 91
Nancy A. Stenholm

THE BOTANICAL ASSEMBLAGE 91
SUMMARY BY ZONE 102
ZONE 4 (Kartar Phase, pre-4500 B.P.) 104
ZONE 3 (Kartar Phase, ca. 4500-4000 B.P.) 104
Unit Level Materials 104
Materials From Feature 1 104
ZONE 2 (Hudnut Phase, ca. 3000-2000 B.P.) 105
ZONE 1 (Coyote Creek Phase, ca. 600 B.P.) 105
Unit Level Materials 105
Materials From Feature 2 106

6. **FEATURE ANALYSIS AND ARTIFACT DISTRIBUTIONS** 107
Ernest S. Lohse

FEATURES 107
FEATURE 1 107
FEATURE 2 109
FEATURES 3 AND 4 110
ARTIFACT DISTRIBUTIONS 113

7. **SYNTHESIS** 119
Ernest S. Lohse

ZONE 4 (Kartar Phase, pre-4500 B.P.) 119
ZONE 3 (Kartar Phase, ca. 4500-4000 B.P.) 120
ZONE 2 (Hudnut Phase, ca. 3000-2000 B.P.) 121
ZONE 1 (Coyote Creek Phase, ca. 6000 B.P.) 121
SUMMARY 122

REFERENCES 125

APPENDIX A: Radocarbon Date Samples and Results of Soil Analyses . . 135

Appendix B: Faunal Assemblage 141

Appendix C: Description of Contents of uncirculated appendices . . . 145

LIST OF FIGURES

Figure 1-1. Location of 45-DO-204 2

Figure 1-2. Site vicinity map 3

Figure 1-3. Sampling plan and excavated units 6

Figure 2-1. Geologic map of site vicinity 10

Figure 2-2. Location of profiled walls and column samples 12

Figure 2-3. Stratigraphic profile of a) unit 10S28W and b) unit 2S38W 15

Figure 2-4. Stratigraphic profile of a portion of the cutbank 16

Figure 2-5. Stratigraphic profile of a) unit 4N22W and b) unit 4N16W 17

Figure 2-6. Topography of cobble surface 19

Figure 2-7. Extent of tephra deposit 21

Figure 2-8. Extent of Zone 4 24

Figure 2-9. Extent of Zone 3 26

Figure 2-10 Extent of Zone 2 27

Figure 3-1. Edge angle by wear-manufacture and wear only 67

Figure 3-2. Edge angle distribution by wear-manufacture and wear only by zone 68

Figure 3-3. Definition of projectile point outline 73

Figure 3-4. Historical projectile point type classification 76

Figure 3-5. Rufus Woods Lake cultural phases in relationship to cultural sequences of nearby study area 83

Figure 5-1. Carbon to soil ratio by zone and unit level 92

Figure 6-1. Plan and profile views of Feature 1 108

Figure 6-2. Plan and profile views of Feature 2 111

Figure 6-3. Plan and profile views of Features 3 and 4 112

Figure 6-4. Concentrations of cultural materials, Zone 4 114

Figure 6-5. Concentrations of cultural materials, Zone 3 115

Figure 6-6. Concentrations of cultural materials, Zone 2 116

Figure 6-7. Concentrations of cultural materials, Zone 1 117

LIST OF TABLES

Table 2-1. Summary of depositional units 14

Table 2-2. Summary of cultural analytic zones 23

Table 3-1. Technological dimensions 32

Table 3-2. Counts and weights of material types by zone 33

Table 3-3. Object type by material by zone 35

Table 3-4. Flake size by material and zone 36

Table 3-5. Count of debitage by material by zone 37

Table 3-6. Measurements of conchoidally flaked material by zone. . 38

Table 3-7. Count of object types by cortex, material, and zone. . . 39

Table 3-8. Count of heat treatment by zone 40

Table 3-9. Heat treatment by material type by zone 40

Table 3-10. Linear flake measurements 41

Table 3-11. Functional dimensions 44

Table 3-12. Wear/manufacture and type of manufacture of formed and modified objects by zone 45

Table 3-13. Functional type and wear areas 47

Table 3-14. Formal type and wear area paradigm 49

Table 3-15. Kind of wear by shape of wear 57

Table 3-16. Kind of wear by location of wear 58

Table 3-17. Kind of wear by shape of wear by object edge angle 60

Table 3-18. Kind of wear by shape of wear by object edge angle by zone 61

Table 3-19. Kind of wear by length of wear by object edge angle 64

Table 3-20. Kind of wear by length of wear by object edge angle by zone 65

Table 3-21. Dimensions of morphological projectile point classification. 72

Table 3-22. Morphological classes of projectile points. 74

Table 3-23. Classified projectile points and fragments 77

Table 4-1. Taxonomic composition and distribution of vertebrate remains 86

Table 5-1. Percentage of archaeological carbon in flotation samples by Zone, depth, and radiocarbon age 93

Table 5-2. The botanical assemblage by flotation weight and number of appearances 94

Table 6-1. Contents and dimensions of features by zone 109

Table A-1. Radiocarbon date samples 136

Table A-2. Results of physical and chemical soil analyses, Column 1 137

Table A-3. Results of physical and chemical soil ansiyses, Column 1A 138

Table A-4. Results of physical and chemical soil analyses, Column 2 138

Table A-5. Results of physical and chemical soil analyses, Column 3 139

LIST OF PLATES

Plate 1-1. 45-DO-204: view to the south (picture from bay in front of site) 4

Plate 1-2. 45-DO-204: view to the west (downriver) 4

Plate 2-1. Profile of 4N16W, south wall, showing basal cobble layer and upper sand strata 18

Plate 3-1. Gravers, bifaces, drills 52

Plate 3-2. Cobble tool types 54

Plate 3-3. Projectile points, linear flakes, shaft abraders 78

Plate 5-1. Pine seeds from Feature 2, Zone 1 98

Plate 5-2. Modern ponderosa pine seed and archaeological pine seed . . 98

Plate 5-3. Plant cortex, longitudinal and cross sections, Feature 2, Zone 1 103

Plate 5-4. Plant cortex closeup 103

Plate 6-1. Profile showing upper sand strata with Feature 2 110

PREFACE

The Chief Joseph Dam Cultural Resources Project (CJDCRP) has been sponsored by the Seattle District, U.S. Army Corps of Engineers (the Corps) in order to salvage and preserve the cultural resources imperiled by a 10 foot pool raise resulting from modifications to Chief Joseph Dam.

From Fall 1977 to Summer 1978, under contract to the Corps, the University of Washington, Office of Public Archaeology (OPA) undertook detailed reconnaissance and testing along the banks of Rufus Woods Lake in the Chief Joseph Dam project area (Contract No. DACW67-77-C-0099). The project area extends from Chief Joseph Dam at Columbia River Mile (RM) 545 upstream to RM 590, about seven miles below Grand Coulee Dam, and includes 2,015 hectares (4,979 acres) of land within the guide-taking lines for the expected pool raise. Twenty-nine cultural resource sites were identified during reconnaissance, bringing the total number of recorded prehistoric sites in the area to 279. Test excavations at 79 of these provided information about prehistoric cultural variability in this region upon which to base further resource management recommendations (Jermann et al. 1978; Leeds et al. 1981).

Only a short time was available for testing and mitigation before the planned pool raise. Therefore, in mid-December 1977, the Corps asked OPA to review the 27 sites tested to date and identify those worthy of immediate investigation. A priority list of six sites, including 45-DO-204, was compiled. The Corps, in consultation with the Washington State Historic Preservation Officer and the Advisory Council on Historic Preservation, established an Interim Memorandum of Agreement under which full-scale excavations at those six sites could proceed. In August 1978, data recovery (Contract No. DACW67-78-C-0106) began at five of the six sites.

Concurrently, data from the 1977 and 1978 testing, as well as those from previous testing efforts (Osborne et al. 1952; Lyman 1976), were synthesized into a management plan recommending ways to minimize loss of significant resources. This document calls for excavations at 34 prehistoric habitation sites, including the six already selected (Jermann et al. 1978). The final Memorandum of Agreement includes 20 of these. Data recovery began in May 1979 and continued until late August 1980.

Full-scale excavation could be undertaken at only a limited number of sites. The testing program data allowed identification of sites in good condition that were directly threatened with inundation or severe erosion by the projected pool raise. To aid in selecting a representative sample of prehistoric habitation sites for excavation, site "components" defined during testing were characterized according to (1) probable age, (2) probable type of occupation, (3) general site topography, and (4) geographic location along the river (Jermann et al. 1978:Table 18). Sites were selected to attain as wide a diversity as possible while keeping the total number of sites as low as possible.

The Project's investigations are documented in four report series. Reports describing archaeological reconnaissance and testing include (1) a management plan for cultural resources in the project area (Jermann et al. 1978), (2) a report of testing at 79 prehistoric habitation sites (Leeds et al. 1981), and (3) an inventory of data derived from testing. Series I of the mitigation reports includes (1) the project's research design (Campbell 1984d) and (2) a preliminary report (Jaehnig 1983b). Series II consists of 14 descriptive reports on prehistoric habitation sites excavated as part of the project (Campbell 1984b; Jaehnig 1983a, 1984a,b; Lohse 1984a-f; Miss 1984a-d), reports on prehistoric nonhabitation sites (Campbell 1984a) and burial relocation projects (Campbell 1984c), and a report on the survey and excavation of historic sites (Thomas et al. 1984). A summary of results is presented in Jaehnig and Campbell (1984).

This report is one of the Series II mitigation reports. Mitigation reports document the assumptions and contingencies under which data were collected, describe data collection and analysis, and organize and summarize data in a form useful to the widest possible archaeological audience.

ACKNOWLEDGEMENTS

This report is the result of the collaboration of many individuals and agencies. During the excavation and early reporting stages, Coprincipal Investigators were Drs. Robert C. Dunnell and Donald K. Grayson, both of the Department of Anthropology, University of Washington, and Dr. Jerry V. Jermann, Director of the Office of Public Archaeology, University of Washington. Dr. Manfred E.W. Jaehnig served as Project Supervisor during this stage of the work. Since the autumn of 1981, Dr. Jaehnig has served as Coprincipal Investigator with Dr. Dunnell.

Three Corps of Engineers staff members have made major contributions to the project. They are Dr. Steven F. Dice, Contracting Officer's Representative, and Corps archaeologists Lawr V. Salo and David A. Munsell. Both Mr. Munsell and Mr. Salo have worked to assure the success of the project from its initial organization through site selection, sampling, analysis, and report writing. Mr. Munsell provided guidance in the initial stages of the project and developed the strong ties with the Colville Confederated Tribes essential for the undertaking. Mr. Salo gave generously of his time to guide the project through data collection and analysis. In his review of each report, he exercises that rare skill, an ability to criticize constructively.

We have been fortunate in having the generous support and cooperation of the Colville Confederated Tribes throughout the entire length of project. The Tribes' Business Council and its History and Archaeology Office have been invaluable. We owe special thanks to Andy Joseph, former representative from the Nespelem District on the Business Council, and to Adeline Fredin, Tribal Historian and Director of the History and Archaeology Office. Mr. Joseph and the Business Council, and Mrs. Fredin, who acted as liaison between the Tribe and the project, did much to convince appropriate federal and state agencies of the necessity of the investigation. They helped secure land and services for the project's field facilities as well as helping establish a program which trained local people (including many tribal members) as field excavators and laboratory technicians. Beyond this, their hospitality has made our stay in the project area a most pleasant one. In return, conscious of how much gratitude we wish to convey in a few brief words, we extend our sincere thanks to all the members of the Colville Confederated Tribes who have supported our efforts, and to Mrs. Fredin and Mr. Joseph, in particular.

Site 45-DO-204 is located on land owned by the Department of Natural Resources of the State of Washington. We thank the State of Washington for granting us permission to excavate the site.

As authors of this report, we take responsibility for its contents. What we have written here is only the final stage of a collaborative process which is analogous to the integrated community of people whose physical traces we have studied. Some, by dint of hard labor and archaeological training, salvaged those traces from the earth; others processed and analyzed those traces; some manipulated the data and some wrote, edited and produced this report. Each is a member of the community essential to the life of the work we have done.

Jerry V. Jermann, Coprincipal Investigator during the field excavation and artifact analysis phase of the project, developed site excavation sampling designs used to select data from each site. Bruce Freyburger supervised the excavation.

S. Neal Crozier did the initial data summary for the stratigraphic analysis as well as the depositional unit analysis and the chemical and mechanical sort analyses. Dr. Ernest S. Lohse compiled the data for feature analysis and zone definitions. The laboratory staff did the technological and functional artifact analysis under the direction of Karen Whittlesey. Janice Jaehnig did keypunching and John Chapman and Duncan Mitchell manipulated the computerized data.

The writing of the report itself is a cooperative effort. Dr. Ernest S. Lohse wrote Chapters 1, 3, 6 and 7; and with Sarah K. Campbell and S. Neal Crozier wrote Chapter 2. As senior author, he also coordinated and integrated the contributions of the other authors. Stephanie Livingston analyzed the faunal assemblage and wrote Chapter 4. Dr. Nancy Stenholm analyzed the botanical assemblage and wrote Chapter 5.

Marc Hudson edited the text and Dawn Brislawn produced report drafts. Fred Clark and James Bennett prepared working copies of many of the figures; Medlodie Tune drafted the final versions except for Figures 6-4 through 6-7, drafted by James Bennett. Larry Bullis photographed the artifacts and made the prints. Charlotte Beck produced the final camera ready copy under the direction ot Sarah K. Campbell.

1. INTRODUCTION

Site 45-DO-204 is on the left bank of the Columbia River about 100 m (328 ft) upstream from River Mile (RM) 567 and about 400 m (1,300 ft) upstream from what was known as Parson's Rapids (Figure 1-1). It lies in the SE1/4 of the SE1/4 of Section 17, T31N, R28E, Boot Mtn. Quadrangle (U.T.M. Zone 11, N5329700, E327200).

45-DO-204 lies on a 308 m (1,010 ft) terrace remnant above a low cutbank that forms the north shore of a long, narrow cove created by the rising waters of Rufus Woods Lake (Figure 1-2 and Plates 1-1 and 1-2). That remnant is part of a whole system of terraces--the ancient beds of the Columbia River--which rise up to the Plateau south of the canyon. Before the 1956 pool raise, the cove was a deep ravine extending into the river channel 70 m (230 ft) to the north, and the site itself was 26 m (85 ft) above the river.

To the north, across Rufus Woods Lake, is the mouth of the Omak Trench, an old Columbia River course that cuts through part of the Okanogan Highlands, and contains Omak Lake and Goose Lake. The nearest major mountains, Whitmore Mtn. (elevation 1056 m [3,464 ft] m.s.l.) and Boot Mtn. (elevation 853 m [2,798 ft] m.s.l.), lie to the east.

Large granitic outcrops and basalt erratics mark the river course in the vicinity of 45-DO-204. These outcrops obstructed the river and formed nearby Parson's Rapids, a favored fishing site of the aboriginal peoples (Ray 1932). Above the rapids was a smooth stretch of river used historically as a ferry site (Condon's Ferry).

A sagebrush-grass association (Artemisia tridentata-Agropyron) (Daubenmire 1970), which is typical of the Upper Sonoran life zone (Piper 1906), dominates the vegetation in the site area. Scattered sagebrush and rabbitbrush (Chrysothamnus nauseosus), spring flowers, and a dense understory of grasses grow on the site (cf., Franklin and Dyrness 1973). Introduced elements include cheatgrass (Bromus tectorum), and thistles (Salsola kali and Cirsium sp.), among others. A more mesic association including rose (Rosa sp.), serviceberry (Amelanchier sp.), horsetail (Equisetum spp.), rushes (Equisetum hymale), tule (Scirpus acutus), and sedges (Carex spp.) is found in nearby drainages.

On the upper terraces above the river, Artemisia rigida replaces big sagebrush in areas of thinner, rocky soils. Bitterbrush (Purshia tridentata) and isolated pines (Pinus ponderosa), with an understory of grasses, grow along the steep draws draining the slopes and terraces. To the south, scattered pines give way to sagebrush covered uplands dotted with small lakes and springs. To the north, across the river, mixed Douglas fir (Pseudotsuga

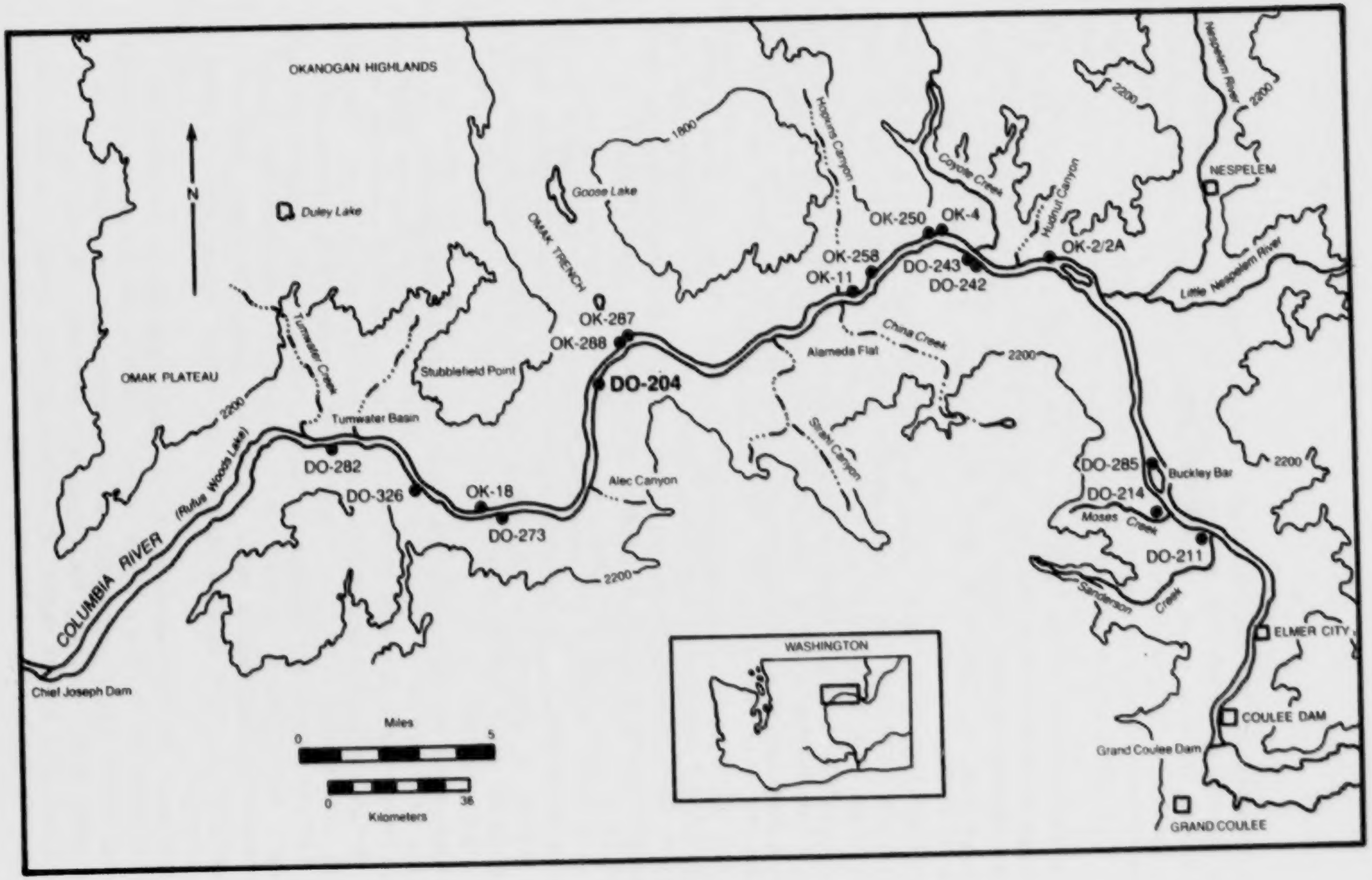

OKANOGAN HIGHLANDS
N
Duley Lake
OMAK PLATEAU
Turnwater Creek
Turnwater Basin
Stubblefield Point
OMAK TRENCH
Goose Lake
1800
Hopkins Canyon
Coyote Creek
Hudnut Canyon
Nespelem River
2200
NESPELEM
Little Nespelem River
OK-250
OK-4
OK-258
OK-11
DO-243
DO-242
OK-2/2A
OK-287
OK-288
DO-204
Alameda Flat
China Creek
Strahl Canyon
2200
DO-282
DO-326
OK-18
DO-273
Alec Canyon
2200
COLUMBIA RIVER
(Rufus Woods Lake)
Chief Joseph Dam
DO-285
Buckley Bar
DO-214
Moses Creek
DO-211
Sanderson Creek
2200
ELMER CITY
COULEE DAM
Grand Coulee Dam
GRAND COULEE
WASHINGTON
Miles
0
5
0
38
Kilometers

Figure 1-1. Location of 45-DO-204.

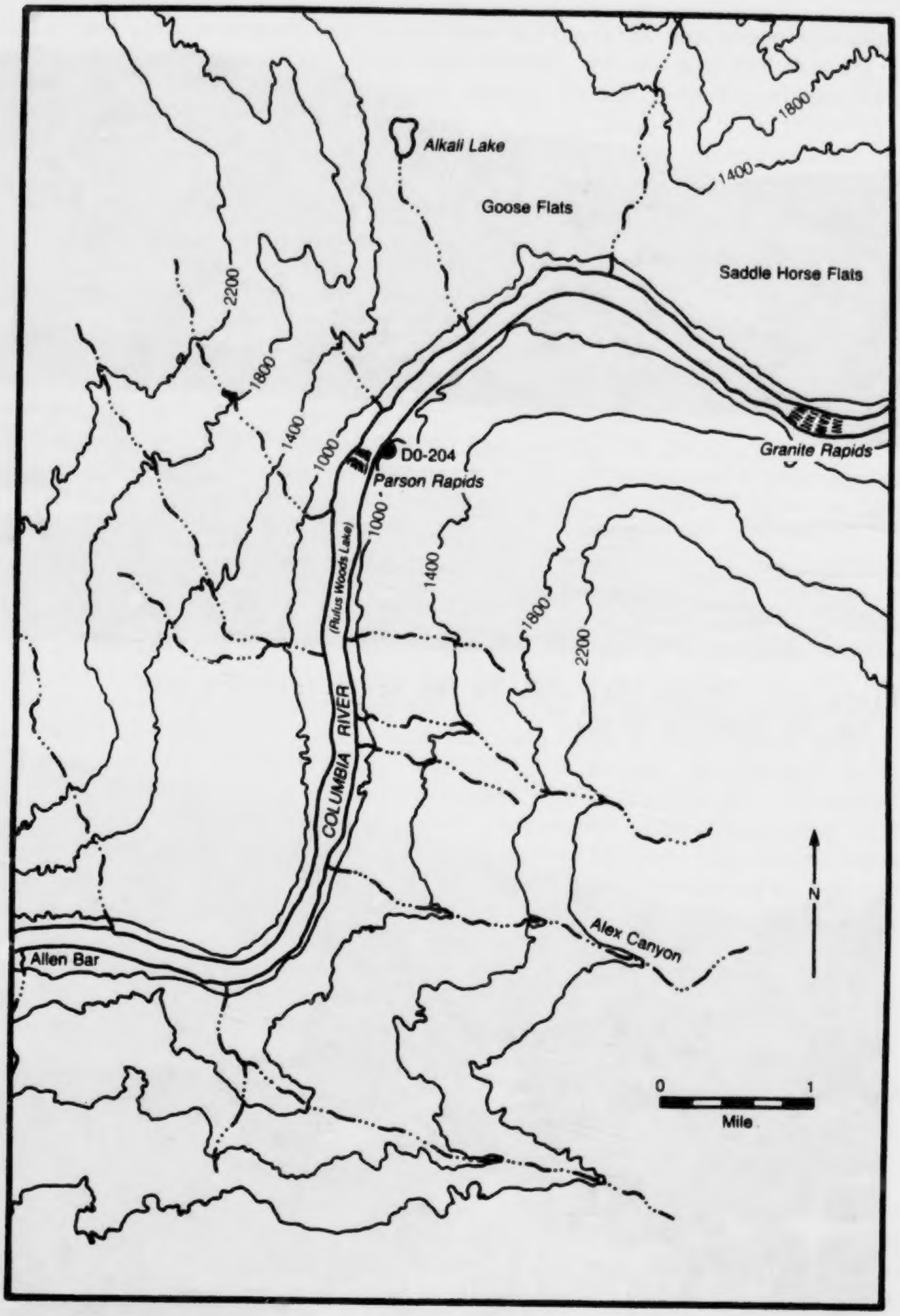

Alkali Lake
Goose Flats
Saddle Horse Flats
1800
1400
2200
1800
1400
1000
DO-204
Parson Rapids
Granite Rapids
1000
1400
(Rufus Woods Lake)
COLUMBIA RIVER
1800
2200
N
Alex Canyon
Allen Bar
0
1
Mile

Figure 1-2. Site vicinity map, 45-DO-204.

Plate 1-1. 45-DO-204: view to the south (picture from bay in front of site).

Plate 1-2. 45-DO-204: view to the west (downriver).

menziesii) and pine are dominant in moister bottomlands and along streams, where they grow with broadleaf trees and shrubs. At the highest elevations, the fir forest gives way to pine forest, except on north-facing slopes and valley floors, where the dominant species is still Douglas fir with larch (*Larix occidentalis*), some spruce (*Picea engelmannii*) and an associated understory of woody shrubs.

Site 45-DO-204 enjoys a favored location. The users of the site would have had a dependable water source and easy access to Plateau uplands. The nearby rapids would have been a prime fishing area, especially during the spring and summer salmon runs (Ray 1932). They could exploit a wide variety of game and wild plants. Seeds and roots could be gathered from spring through fall. Large game species like elk and deer ranged between upland and river. Smaller species were restricted in range to specific vegetation communities and water sources. Migratory waterfowl were plentiful along rivers, streams, and lake margins during the spring and fall. The river yielded suckers and freshwater mussels. Site inhabitants could have exploited any of these species, scheduling their visits or activities to coincide with the availability of specific resources.

INVESTIGATIONS AT 45-DO-204

Site 45-DO-204 was first recorded by R. L. Lyman in 1975 (Lyman 1976). It was selected for investigation because testing in the summer of 1977 had disclosed at least two cultural components dating to two separate cultural periods (RWL I and RWL III). A radiocarbon date from a large earth oven placed one occupation at 592±71 B.P. (TX-2897). A second radiocarbon date from a living surface placed another occupation at 2812±344 B.P. (TX-2896). It appeared likely that these two distinct components widely separated in time would provide the opportunity for recovering extensive artifact assemblages from two separate prehistoric periods. The density of the cultural materials was a second factor, leading the investigators to suspect multiple occupations at least over the time-span encompassed by the two radiocarbon dates. Finally, the site's location near Parson's Rapids indicated it might be an ideal spot for a summer settlement or fishing camp.

Site 45-DO-204 was excavated during the 1978 field season, with work beginning on 6 September and ending on 1 November 1978. The field crew consisted of six to ten excavators under the direction of a field supervisor.

A two stage sampling design was used at 45-DO-204. During the first stage, a probabilistic sample of units was selected for excavation. Five sampling strata were established across the site surface. Four of these consisted of 21 2 x 2-m grid units arranged in square quadrat arrays. The fifth held 23 2 x 2-m grid units in a square quadrat array (Figure 1-3). Two excavation units were randomly selected within each stratum. The second stage of sampling was implemented when high densities of artifacts were identified in units placed near the supposed periphery of the site. Because the site promised to yield more extensive cultural deposits, 13 additional sampling strata were constructed. Again, two random excavation units were selected from each stratum; this time, however, they were 1 x 2-m excavation units.

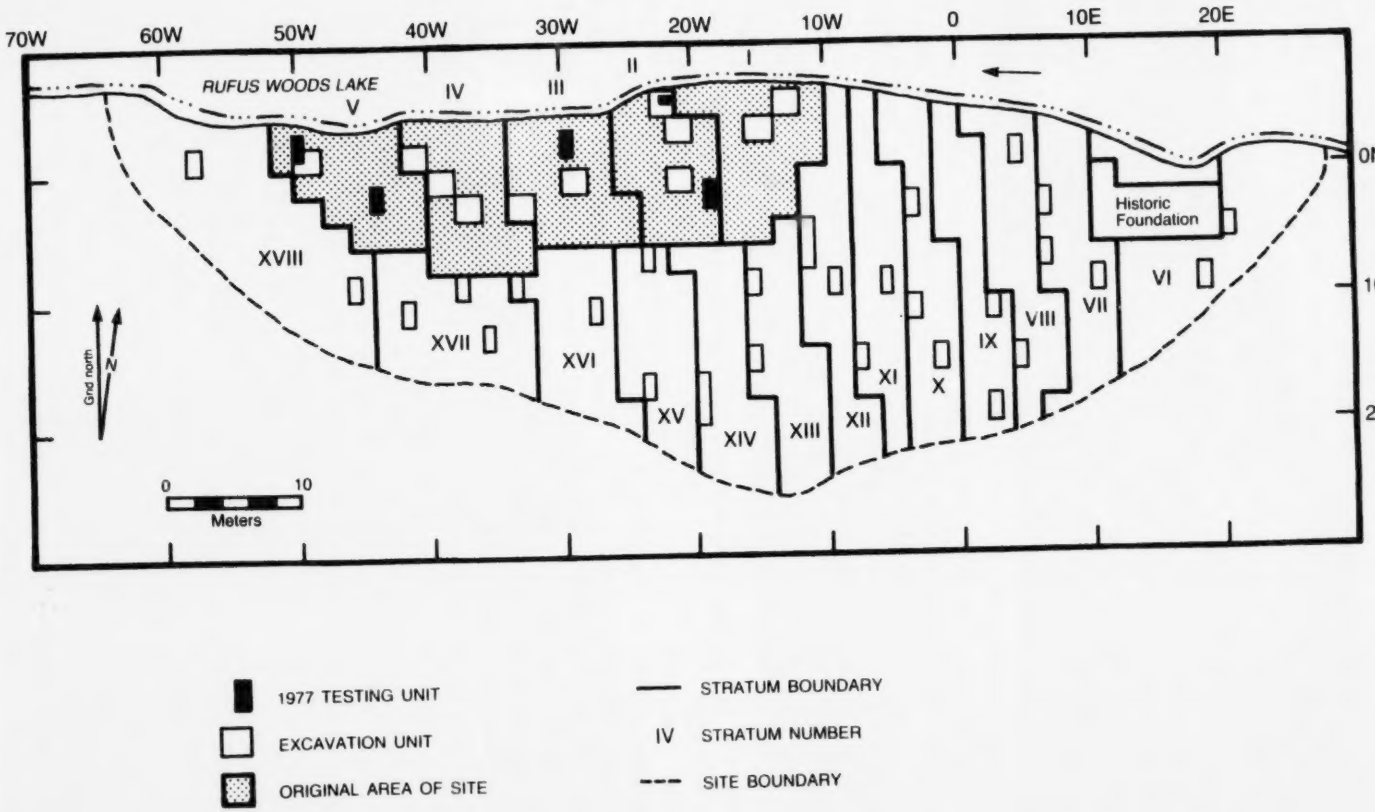

70W
60W
50W
40W
30W
20W
10W
0
10E
20E
0N
10S
20S
RUFUS WOODS LAKE
I
II
III
IV
V
VI
VII
VIII
IX
X
XI
XII
XIII
XIV
XV
XVI
XVII
XVIII
Historic Foundation
Grid north
N
0
10
Meters
1977 TESTING UNIT
EXCAVATION UNIT
ORIGINAL AREA OF SITE
STRATUM BOUNDARY
IV STRATUM NUMBER
SITE BOUNDARY

Figure 1-3. Sampling plan and excavated units, 45-DO-204.

One purposive unit--a 2 x 2-m square was placed over the earth oven identified and dated in testing.

Each excavation unit was designated by its northwest corner grid point, and all grid units were subdivided into 1 x 1-m quadrants. Excavation proceeded in arbitrary 10-cm levels measured from the surface at the northwest corner of each grid unit. When a difference in matrix composition was encountered, it was recorded as a feature, and excavated separately. Excavators used flat-nosed shovels to skim the earth until a cultural feature was identified; then they removed matrix with trowels. All material was sifted through one-eighth inch screens. Additional information on excavation procedures can be found in the project research design (Campbell 1984d).

One hundred and four m^2 of the 1000 m^2 site was excavated. The excavators' work resulted in the identification of four analytic zones; they exposed four cultural features: a shallow, unlined firepit in Zone 3, radiocarbon dated at 4590±143 B.P. (TX-4023); a thick lens of stained sand associated with the testing date of 2812±344 B.P.; a large earth oven and nearby cobble pile associated with the testing date of 592±71 B.P. (TX-2897) and another radiocarbon date of 655±67 B.P. (TX-4024). Excavators recovered 2,682 stone artifacts, 5,180 whole and fragmented bones, 4 pieces of shell, and 627 fire-modifed rocks. Within this assemblage are 248 worn and manufactured artifacts encompassing a range of lithic and non-lithic tools.

REPORT FORMAT

The following chapters present the results of investigations at 45-DO-204. Chapter 2 begins with a discussion of the geologic setting of the site; describes the depositional units, and then defines the cultural zones. Chapter 3 gives the results of three separate analyses--technological, functional, and stylistic--that were applied to the artifacts. Chapter 4 describes the faunal remains recovered from the site, and briefly discusses the inferences that may drawn from them regarding the seasonality of occupations at the site. Chapter 5 describes botanical material found at the site; considers the inferences that might be drawn from them regarding prehistoric economics; and notes seasonally available species. Chapter 6 describes constituent features. Chapter 7 summarizes the site's cultural deposits, and makes inferences from them concerning the nature and chronology of cultural occupations; and then places these findings in the context of the region's previous archaeology.

2. NATURAL AND CULTURAL STRATIGRAPHY

This chapter discusses the geologic setting of site 45-DO-204 with reference to local geologic history and describes the sedimentary history of the site itself in detail. Strata mapped during excavation are grouped into site-wide depositional units, which provide the basis for determining how deposition occurred and for correlating cultural materials among units. The second half of the chapter discusses the cultural strata, or analytic zones, defined within this framework.

GEOLOGIC SETTING

The Columbia River channel in the project area was established during the late Miocene when it was carved into the juncture of the Columbia River Basalts (Waterville Plateau) and the gneissic rock of the Colville Batholith (Okanogan Highlands). During the Pleistocene, the middle and northern reaches of the Columbia River drainage were overlain several times by ice sheets. The Okanogan Lobe of the Cordilleran ice sheet filled the upper canyon to the Grand Coulee, reaching its maximum extent between 13,000 and 14,500 years B.P. By the time of the Glacier Peak ashfall (12,000-13,000 B.P.), the glacier had withdrawn to the Canadian border. The ice in the upper canyon wasted away earlier than that in the lower canyon, resulting in an ice dam that ponded the river waters. A thick deposit of glaciolacustrine sediments was laid down in the upper canyon. When the lower ice dam finally was breached, the Columbia River rapidly cut down through these lacustrine sediments, creating a deep, narrow valley with prominent terrace systems. The date of this downcutting is not known, but Fryxell (1973) notes that the process had begun by the time of the Glacier Peak ashfall. The presence of Mazama tephra in alluvial fans built onto the 1,000 ft (304 m) terrace indicates that the river had reached this elevation sometime before 7000 B.P., and probably reached historic elevations shortly thereafter (Hibbert 1980).

Since this time, less dramatic depositional and erosional processes have shaped the local landscape: lateral migration, point bar and overbank deposition of the river, alluvial fan development, colluvial deposition, and aeolian deposition. There is little floodplain development in this narrow and incised valley but natural levees and abandoned channels do exist. Lateral migrations of the channel are recorded by the shape of the river, point bar formation, and erosional episodes preserved in site profiles.

Site 45-DO-204 lies at the downstream end of a large terrace on the Douglas County side of the Columbia River opposite Goose Flats at the mouth of the Omak Trench (Figure 2-1). The northernmost portion of this terrace lies

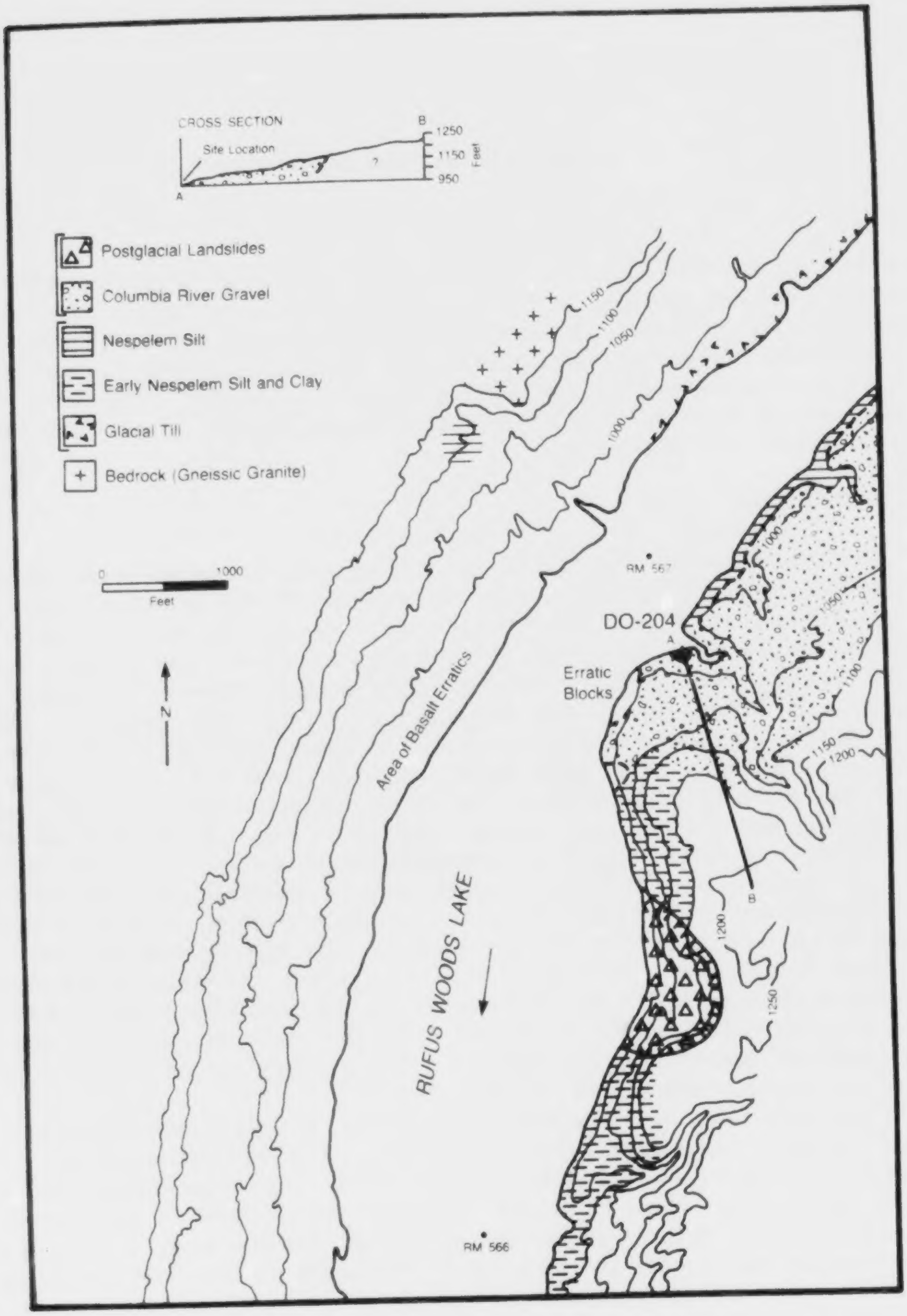

CROSS SECTION
B
1250
Site Location
1150
Feet
950
?
A
Postglacial Landslides
Columbia River Gravel
Nespelem Silt
Early Nespelem Silt and Clay
Glacial Till
Bedrock (Gneissic Granite)
0
1000
Feet
N
1150
1100
1050
1000
Area of Basalt Erratics
RM 567
DO-204
A
Erratic Blocks
1000
1050
1100
1150
1200
RUFUS WOODS LAKE
B
1200
1250
RM 566

Figure 2-1. Geologic map of site vicinity, 45-DO-204.

between 293 m (961 ft) and 305 m (1,000 ft) above m.s.l. A steep slope rises from this area to the upper part of the terrace, which lies between 329 m (1,079 ft) and 341 m (1,118 ft) above m.s.l. Another, less well developed terrace in the southwestern part of the site lies between 305 m (1,000 ft) and 317 m (1,040 ft) above m.s.l. Several small drainages dissect the southern end of the lower terrace; directly east of the site is a deep, ephemeral stream channel. A steep river cutbank reveals the underlying Nespelem silts, which can be correlated with a thick silt deposit immediately downriver from the site.

The terrace on which the site lies is part of the prominent terrace system grading from 335 m (1,099 ft) m.s.l. at Grand Coulee Dam to 305 m (1,000 ft) m.s.l. in the Rufus Woods Lake Reservoir (Hibbert 1980), created when the Columbia River dissected the older lake fill. The terraces are covered with up to 5 m of gravels, deposited by the river as it migrated northward. The 293-341 m (961-1,118 ft) terrace at 45-DO-204 indicates at least one stillstand during the northward migration of the river. At the southern end of the site, the river apparently did not migrate beyond its present position; the 305-317 m (1,000-1,040 ft) terrace on the Okanogan side is quite close to the modern shoreline. At some point since the building of nearby alluvial fans, the regional climate must have become drier, since feeder streams are deeply entrenched in their own fans.

The cultural materials at 45-DO-204 lie in a series of sediments that were laid down after the cutting of the 305-317 m (1,000-1,040 ft) terrace and its capping with river-deposited gravels. These sediments, composed of alluvium from the slope above and overbank deposits, have been eroded by minor river fluctuations. The pedology crew noted that fluctuations in the level of Rufus Woods Lake of no more than 30 cm caused slumping of the cutbank. Given the amount of cultural material visible in the cutbank profile, we may assume that a considerable portion of the site has been washed away.

PROCEDURES

Site 45-DO-204 was excavated and profiled in 1978 before the full-time stratigraphy crew took over profiling and sediment sampling. To achieve consistency in method, the stratigraphy crew reopened and profiled 30 meters of wall in six excavation units in 1980 (Figure 2-2). It was not possible to reprofile all of the walls because of time constraints. Units were selected to provide north-south and east-west cross-section of the site deposits, and an additional 14.2 m of the eroding cutbank were profiled. Column samples were taken from the cutbank and from two of the six interior excavation units--a total of 49 samples from three columns. Methods and procedures used in stratigraphic profiling, column sampling, and sediment analysis are described in more detail in the project's research design (Campbell 1984d).

Our interpretation of the depositional history of 45-DO-204 is based on excavator's notes as well as on the six profiles drawn by the stratigraphy crew. Although the latter provide the most detailed and accurate information about site sediments, their horizontal coverage is limited. Excavator's notes are our only source of information for the marginal areas of the site. In

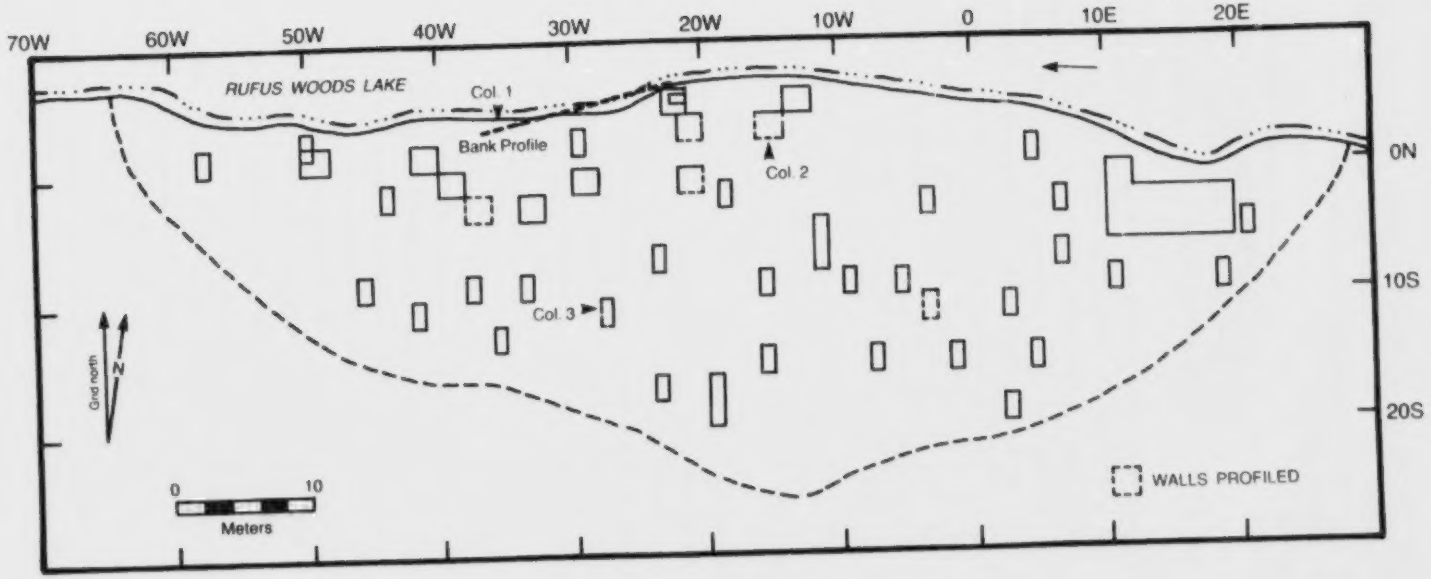

70W
60W
50W
40W
30W
20W
10W
0
10E
20E
0N
10S
20S
RUFUS WOODS LAKE
Col. 1
Bank Profile
Col. 2
Col. 3
WALLS PROFILED
Grid north
N
0
10
Meters

Figure 2-2. Location of profiled walls and column samples, 45-DO-204.

addition, the notes contain many sediment descriptions which can be related to the profile strata and provide us with additional horizontal information about the extent, topography, and variation in certain depositional units.

The stratigraphic boundaries were used as temporal markers to aid in subdividing the cultural deposits for analysis. For the profiled units, the horizontal and vertical distribution of artifacts by quad and level was compared with the natural depositional sequence and feature boundaries. Those stratigraphic units containing a discrete cultural deposit were defined as analytic zones. The zones were extrapolated to adjacent units with the aid of field notes and other chronological information such as radiocarbon dates and projectile points. For a more detailed discussion of procedures used in defining analytic zones, see Campbell (1984d).

COLUMN SAMPLE DESCRIPTIONS

The column sample locations chosen encompass a major portion of the cultural and natural depositional sequence at the site. For the complete results of our column sample analyses please refer to Appendix A, Tables 2 through 4.

Column Sample 1 includes a sample from every stratum of the cutbank. The profiled walls of the cutbank indicate stratified layers of cultural material to a depth of 70 cm below the present surface. Below these layers is a section of banded overbank deposits, stratified gravel, and coarse sand more than 1 m deep. Sandwichod between the gravel layers are pockets of Mazama ash. All samples are very high in angular to subrounded material grains. Textural classifications range from sand to loamy sand and sandy loam.

Column Sample 2 consists of 11 samples from the south wall of unit 4N16W. Conspicuously layered with gravel and coarse sand, this unit reveals few cultural materials. It lies in the path of an ancient stream channel, which extends to the eastern section of the cutbank.

Column Sample 3 was taken from the west wall of unit 10S28W. Stratigraphically, the deposits were typical neither of the cutbank nor of other units at the site. We selected this unit for sampling because it contained what appeared to be Mazama ash. Rodent activity has redistributed some of the ash in the upper levels (Samples 3-8); most of it, however, probably washed down from a large deposit on the upper terrace. Sample 9 is approximately 70% ash and may represent a primary deposit that settled in a small depression. Chemical results from samples containing ash throughout the project area consistently have shown a high calcium and low phosphate content.

The pH results deserve a note of caution. Results on the pH scale between approximately eight and nine measure the concentration of $CaCO_3$. However, readings exceeding nine measure the concentration of sodium ions and thus the results are less reliable. Nevertheless, because $CaCO_3$ concentrates in the lower levels, the pattern of increasing alkalinity with sample depth is common throughout the project area.

The relatively low amounts of phosphate accompanied by high amounts of calcium may indicate a fairly rapid depositional sequence. This is particularly evident on the cutbank where numerous thin lenses were apparently rapidly deposited before the phosphate could stabilize.

Finally, the predominantly angular to subangular grains and poorly sorted sediments are commonly found in alluvial fan and slope wash deposits. The more pitted sub-angular grains in the upper strata are interpreted as wind deposited sediments.

DEPOSITIONAL HISTORY

Based upon study of field profiles, excavator's notes, and physical and chemical analyses, we have grouped the field-defined strata into four sitewide depositional units. Table 2-1 summarizes the characteristics of the depositional units. Stratigraphic profiles of selected units are shown in Figures 2-3 through 2-5.

Table 2-1. Summary of depositional units, 45-DO-204.

Depositional Unit	Subunit	Strata	Description
V Slopewash		100, 200, 210 220, 250	10YR 5/3-6/3 sand, poorly sorted, mixed fractions, loose, soft, occasional pockets of gravel, extremely variable in texture, may include some coarse, gravelly units, also some well sorted fine sand lenses.
IV Upper bar deposit	IVb	300, 310, 330, 350, 390, 400, 450, 500	10YR 513 sand varying to gray salt and pepper sand, fine to medium, moderately to well sorted, variable in texture towards top in occasional areas of gravel or very fine sand, massively bedded. Areas of organic stain (390, 350).
	IVa	600, 650, 660	10YR 6/3-7/2 sand to loamy sand, fine to medium, well sorted, soft, micaceous, occurs banded with very fine loamy sand, slightly hard in cut-bank, occasional pockets of sand and gravel towards base. Massively bedded.
III Lower Bar deposit		700, 750, 800 825, 850, 830, 831, 900, 950	Medium to coarse salt and pepper sand, soft, well sorted alternating with fine to medium 10YR 7/2 sands, well sorted, soft; occasional lenses of poorly sorted sand and gravel.
II Alluvial fan	IIa	770, 1001, 1002	10YR 8/2 loamy sand, very fine, well sorted, slightly hard, ashy, grading downward. Mazama Ash.
		470, 700, 750, 760, 800	Light-gray (10YR7/1) loamy sand to salt-pepper sand. Moderately to poorly sorted sands with some gravel and gravel pockets.
I Columbia River Gravel		—	Dense layer of rounded cobbles.

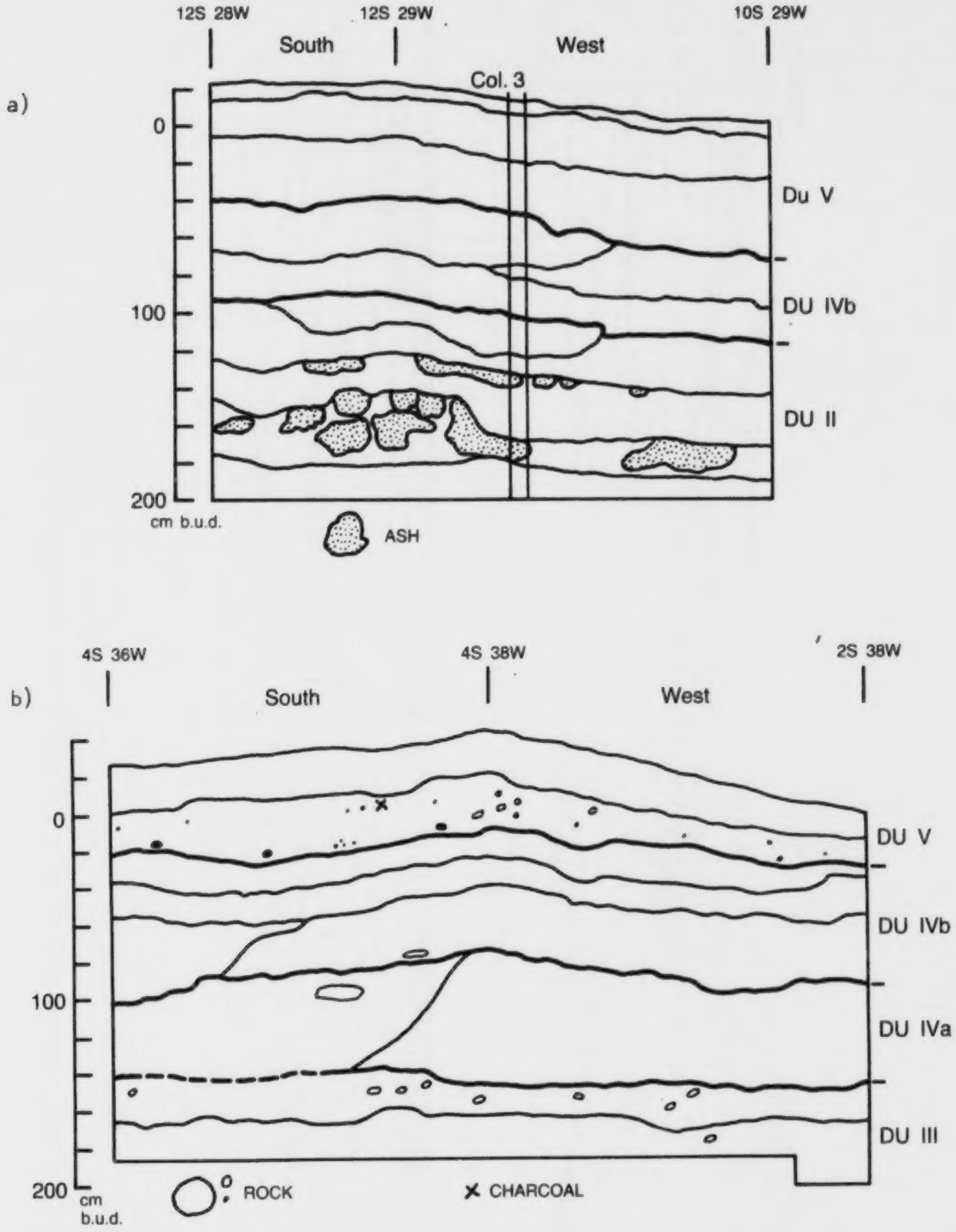

a)
12S 28W
12S 29W
10S 29W
South
West
Col. 3
0
100
200
cm b.u.d.
Du V
DU IVb
DU II
ASH
b)
4S 36W
4S 38W
2S 38W
South
West
0
100
200
cm
b.u.d.
DU V
DU IVb
DU IVa
DU III
ROCK
CHARCOAL

Figure 2-3. Stratigraphic profile of a) unit 10S28W and b) unit 2S38W, 45-DO-204.

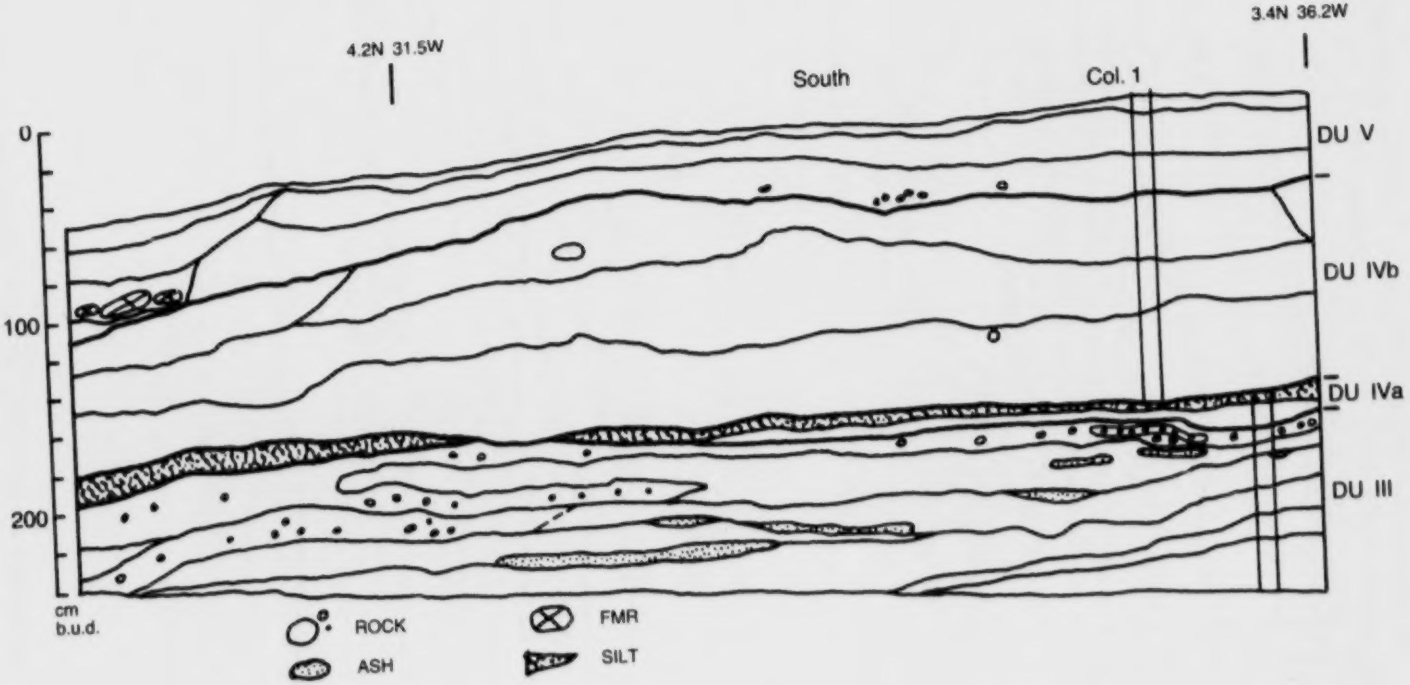

4.2N 31.5W
South
Col. 1
3.4N 36.2W
DU V
DU IVb
DU IVa
DU III
0
100
200
cm
b.u.d.
ROCK
ASH
FMR
SILT

Figure 2-4. Stratigraphic profile of a portion of the cutbank, 45-DO-204.

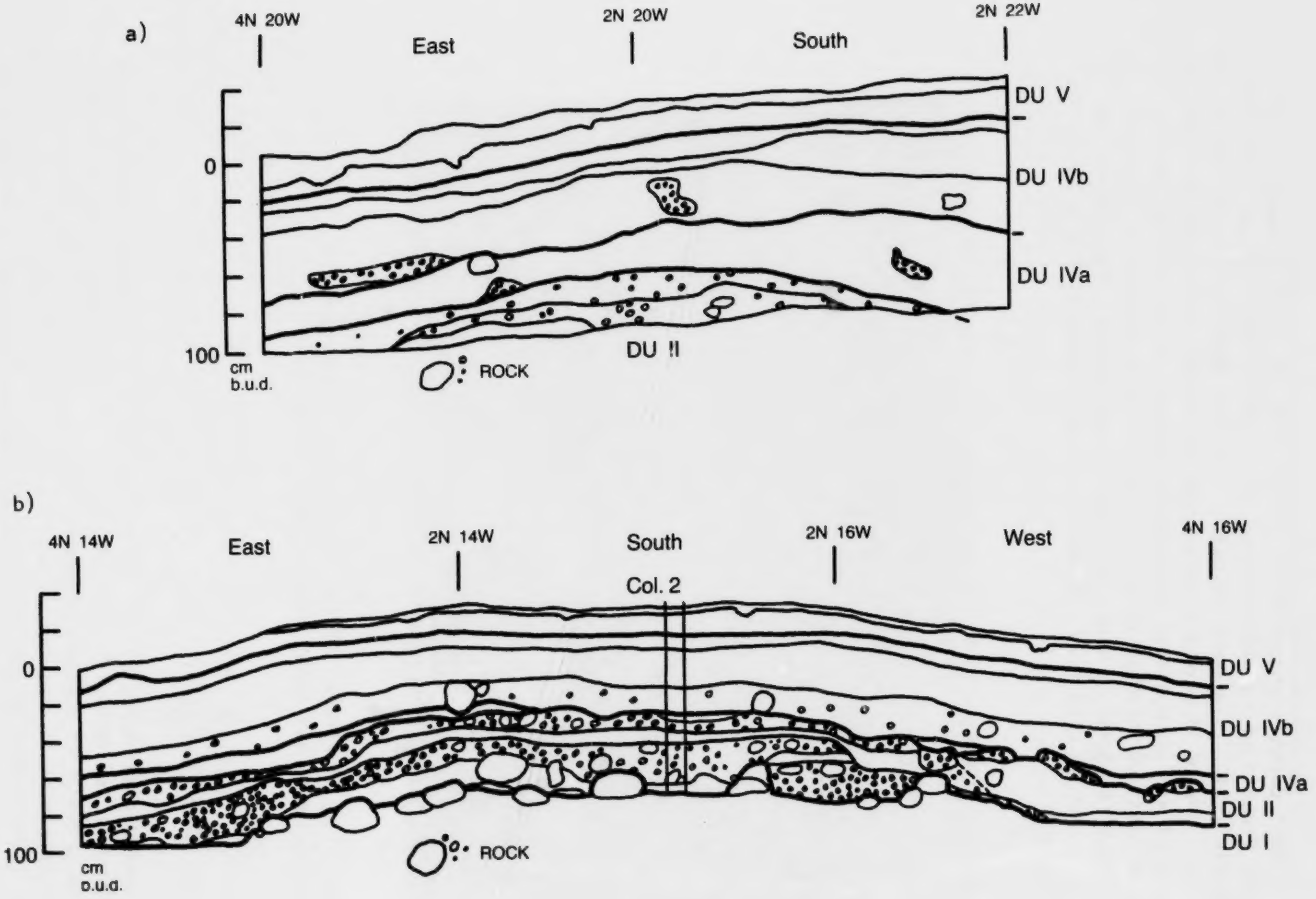

a)
4N 20W
East
2N 20W
South
2N 22W
DU V
DU IVb
DU IVa
DU II
0
100
cm
b.u.d.
ROCK
b)
4N 14W
East
2N 14W
South
Col. 2
2N 16W
West
4N 16W
DU V
DU IVb
DU IVa
DU II
DU I
0
100
cm
b.u.d.
ROCK

Figure 2-5. Stratigraphic profile of a) unit 4N22W and b) unit 4N16W, 45-DO-204.

DEPOSITIONAL UNIT I--Columbia River Gravels

The oldest deposit encountered at the site, DU I, is a basal river channel bed deposit of rounded cobbles in a coarse sand, gravel, and pebble matrix (Plate 2-1). It slopes downward from the southeast to the northwest (Figure 2-6). While it brought excavation to a halt at the eastern end of the site, where it was encountered between 30 cm and 1 m below the surface, the cobble layer was not reached by excavation units elsewhere on the site. A probe by the stratigraphic crew, however, revealed that the channel bed extended at least to grid line 10S where it was encountered 2 m below the present surface.

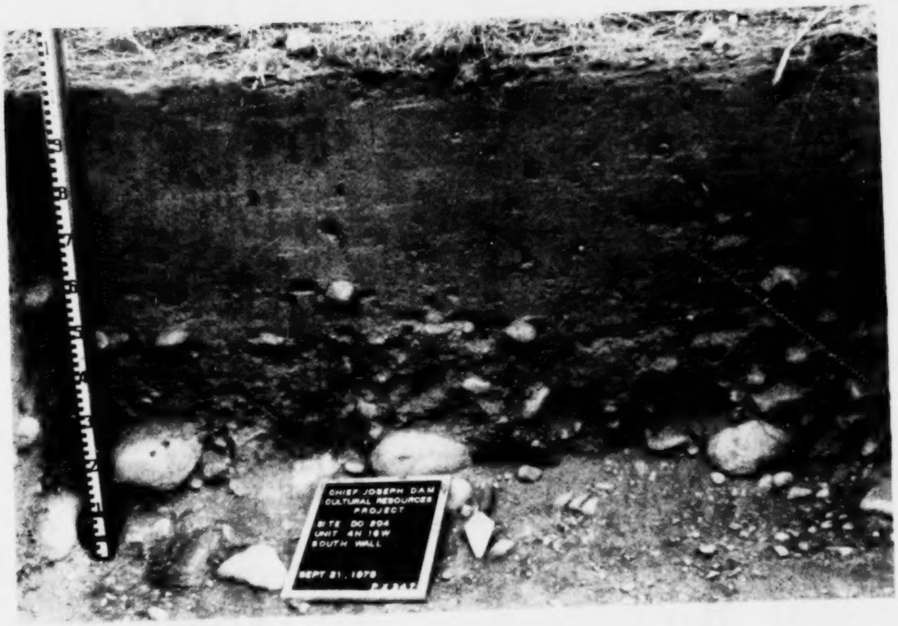


Plate 2-1. Profile of 4N16W, south wall, showing basal cobble layer and upper sand strata, 45-DO-204.

DEPOSITIONAL UNIT II--Alluvial Fan

The next oldest depositional unit, DU II, is an alluvial fan built out onto the channel bed deposit. Its stratified deposits vary widely in texture, from coarse gravels to volcanic tephra. The competence of the intermittent streams contributing to the fan no doubt varied considerably through time and slope wash contributed to the accretion as well. These poorly sorted sands and gravels are thicker in the south towards their source, and thin out to the

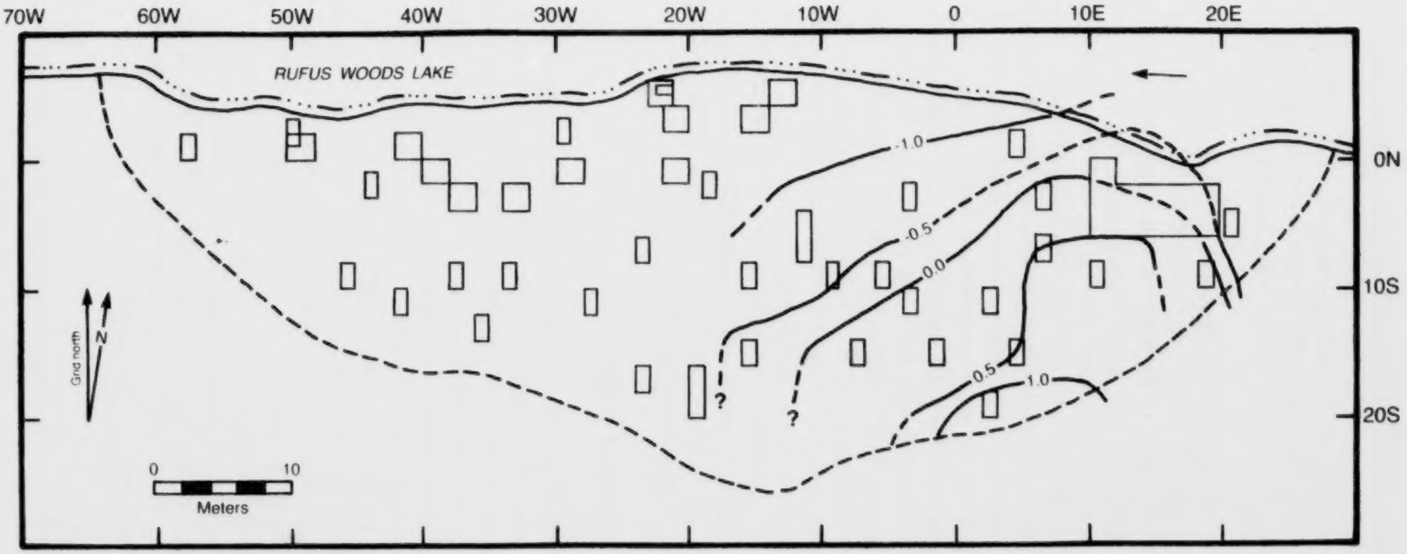

70W
60W
50W
40W
30W
20W
10W
0
10E
20E
0N
10S
20S
RUFUS WOODS LAKE
-1.0
-0.5
0.0
0.5
1.0
?
?
Grid north
N
0
10
Meters

Figure 2-6. Topography of cobble surface, 45-DO-204 (meters relate to site datum).

north toward the river. In the southern units, coarse debris--poorly sorted angular gravels--directly overlie the river cobbles. Along the cutbank, layers, pockets, and lenses of gravel were observed in a coarse sand matrix. Microscopic analysis revealed that the grains were angular to subangular, and composed primarily of quartz. As the river became entrenched, it cut and narrowed this deposit.

Contained within the sands and gravels of the alluvial fan is an internally stratified lobe of finer sediments consisting of a layer of compact tephra overlain by sandy loam with tephra (DU IIa). The deposit is limited in extent, thinning out towards the west, east, and north (Figure 2-7). For example, the loamy sand and compact ash layer are nearly 80 cm thick in unit 16S24W, while in units 10S29W and 14S16W the compact ash is only present as scattered clumps. Although excavation generally was terminated if the compact ash was encountered, the few instances where excavation continued revealed that the ash overlies fine to medium-grained sand, which in turn overlies the cobble layer, DU I (see unit 14S16W profile). The compact volcanic ash deposit probably was concentrated by wind and water shortly after the ash fell. The overlying sandy loam indicates reworking and redeposition of ash after the surface had generally stabilized. We believe these sandy loams and loamy sands surrounding the tephra were laid down within micro-drainage basins formed by a network of ephemeral streams.

To verify the field identification of the fine deposit as volcanic ash, we compared the clay-sized constituents under the microscope with known tephra samples (collected by D. Hibbert in 1979). Davis (1984) has positively identified samples of this tephra as Mazama Ash.

DEPOSITIONAL UNIT III--Coarse Sands

The next depositional unit in the stratigraphic sequence, DU III, a series of relatively clean, coarse sands, is both coeval with and younger than DU III. This sand layer overlies the DU I cobbles in the eastern portion of the site and increases in thickness towards the west and south. DU III does not extend into the higher levels of the site along the southern perimeter, where the DU IIa ash layer is thickest. However, these sands do overlie a layer of compact ash in unit 6S24W. Small pockets of ash found in DU III in the cutbank profile must be secondary deposits; if they are contemporary with the primary ash deposits in DU III, then some of DU III is coeval with DU II. The upper stratum generally has the unit's coarsest sediments, ranging from sand with pebbles and small cobbles to coarse sand. Because they are generally well sorted, and thickest towards the river, these sediments are interpreted as a basal Columbia River bar deposit. The pebbles and cobbles in some strata indicate a contribution of coarser material by slope wash or intermittent stream action.

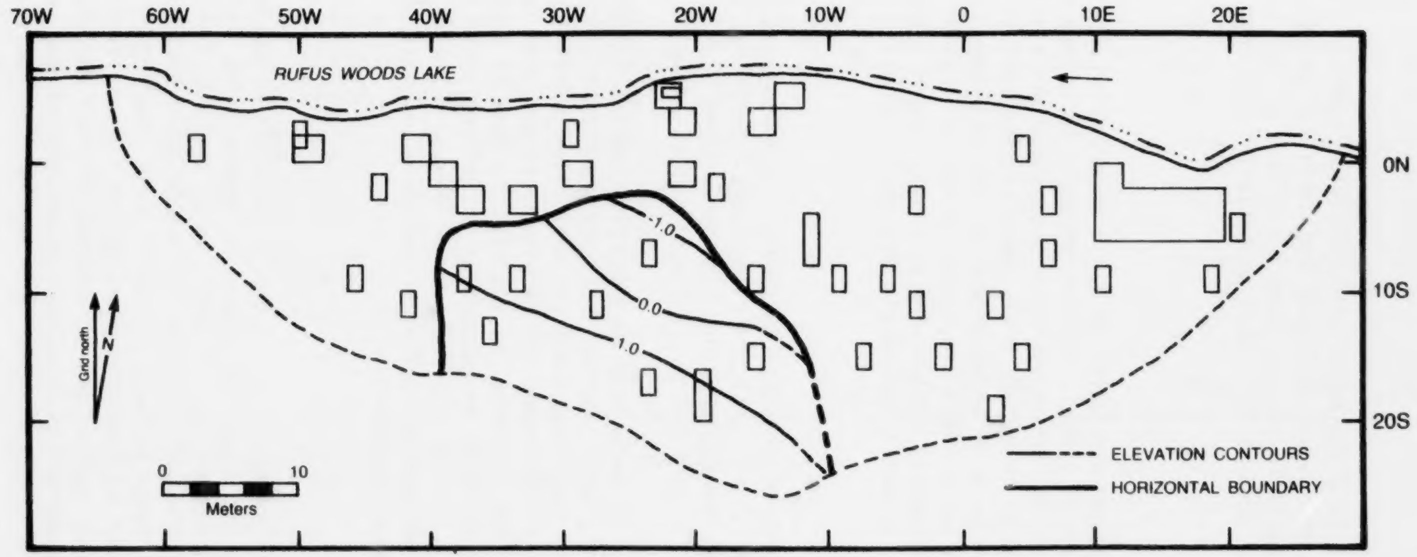

70W
60W
50W
40W
30W
20W
10W
0
10E
20E
0N
10S
20S
RUFUS WOODS LAKE
-1.0
0.0
1.0
Grid north
N
0
10
Meters
ELEVATION CONTOURS
HORIZONTAL BOUNDARY

Figure 2-7. Extent of tephra deposit, 45-DO-204 (elevation in meters relative to site datum).

DEPOSITIONAL UNIT IV

Overlying DU III is a series of finer alluvial overbank deposits, DU IV. These strata are thicker towards the west and north and generally are more massive and less variable in texture than the strata of DU III. Gravel occurring in the upper part of this unit probably derives from the slope above the site.

DEPOSITIONAL UNIT V

The youngest depositional unit, DU V, is a series of poorly sorted sands with occasional pockets of gravel, and was probably laid down by short-term, poorly integrated alluvial action on the slopes above the site. These slope wash deposits increase in thickness toward the western part of the site. This area also contains evidence of an ephemeral stream bed, manifest in a layer of cobbles or pebbles in units 1S44W (testing), 8S38W, and 8S46W. The stream deposit is at its thickest in 10S42W where it consists of a cobble layer overlying a series of alternating gravels and sandy silts.

ANALYTIC ZONES

Four separate cultural episodes corresponding to natural stratigraphic divisions were defined as cultural analytic zones. Table 2-2 summarizes these correspondences, gives the radiocarbon dates associated with each zone, and each zone's contents. Figure 2-8 shows the extent of analytic zones across the site area.

It should be kept in mind that an analytic zone may encompass a large cut of complex site stratigraphy. Rather than representing a single circumscribed occupation, it usually comprises numerous activities occurring over a fairly long span of time. Analytic zones may be viewed as cultural occupations or cultural components. For instance, if a living surface is identified within a zone, it can be referred to as an occupation--a definable set of activities that may be isolated within a limited span of time. If cultural affiliation can be documented, a defined occupation or series of occupations within a zone may be called a cultural component.

ZONE 4

Zone 4, dating in excess of 4,500 years, consists of cultural material from the alluvial fan and lower bar deposits, Depositional Units II and III. The smallest cultural assemblage, it contains no cultural features. Exposed in all excavation units except those in the easternmost part of the site (Figure 2-8), it held large numbers of rodent bone, bearing out the excavators' descriptions of rodent burrows in the lowest levels. The paucity of cultural remains and lack of any structured artifact associations indicate secondary cultural deposits. Only excavation unit 2S34W may be an exception--artifact densities are slightly higher and include fire-modified rocks.

Table 2-2. Summary of cultural analytic zones, 45-DO-204.

Zone	DU	Stratum	Major Description	Radiocarbon[1] Dates (Years B.P.)	Lithic #	Bone (gms)	Shell (gms)	FMR (gms)	Total[2]	# Features	Volume (m^3)	Density Objects/m^3
1	V		Slope wash	655 ± 67	579	523		245	1,347	2	63.8	21.1
2	IVb	300 400	Upper bar deposit	2812 ± 334	1,027	2,318		188	3,533	1	32.3	109.4
3	IVa	600,700 750	Upper bar deposit	4395 ± 106	931	1,635	2	173	2,741	1	25.5	107.5
4	III		Lower bar deposit		145	703	2	21	871		32.2	27.0
	II		Alluvial fan									
	Total				2,628	5,179	4	627	8,492	4	153.8	55.2

[1] See Appendix A for more detailed information on radiocarbon date samples.
[2] Does not include historic material or miscellaneous.

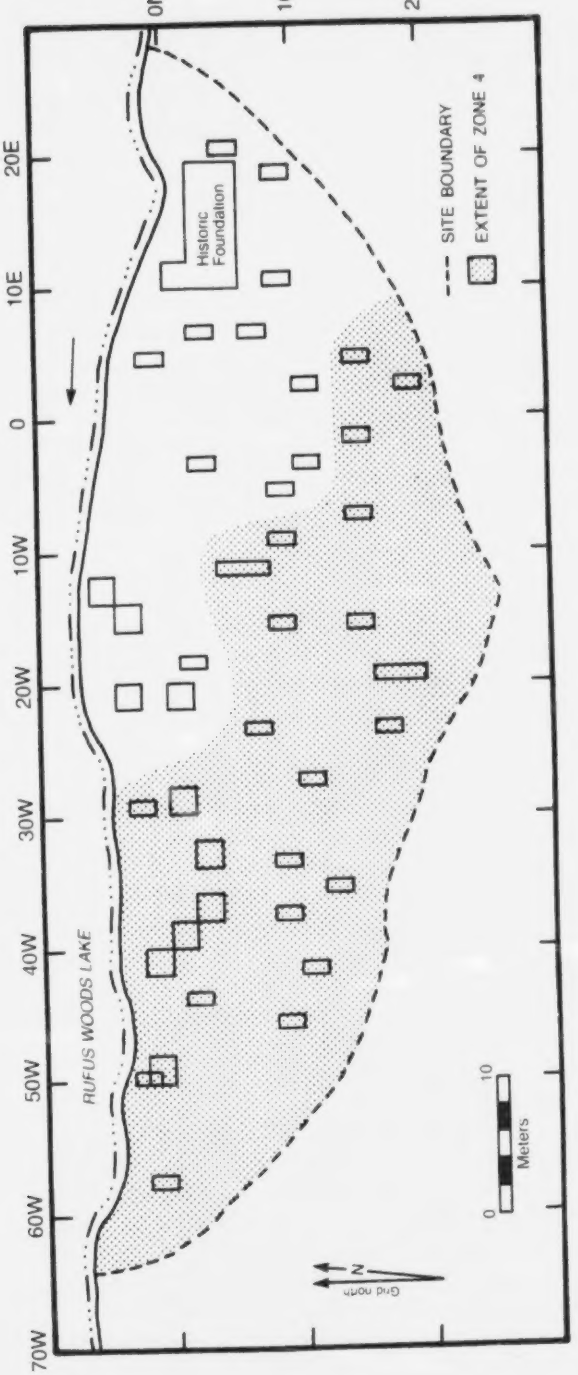

0N
10S
20S
20E
10E
0
10W
20W
30W
40W
50W
60W
70W
Historic Foundation
RUFUS WOODS LAKE
SITE BOUNDARY
EXTENT OF ZONE 4
0
10
Meters
N
Grid north

Figure 2-8. Extent of Zone 4, 45-DO-204.

ZONE 3

This zone, dating from ca. 4500-4000 B.P., includes Strata 750-600 of DU IV. Identified as overbank deposits, these strata show a much more limited distribution across the site area than the alluvial and colluvial deposits identified in Zone 4 (Figure 2-9). This is the second largest cultural assemblage at the site, and includes a well-defined firepit.

ZONE 2

Analytic Zone 2, radiocarbon dated at ca. 2800 B.P., incorporates the upper Strata (400-300) of DU IV. Again, these strata do not occur across the entire site (Figure 2-10), being absent from the higher areas which were apparently above the level of overbank deposition. The cultural assemblage is the largest recovered, and is composed of lithic materials, FMR, and bone. Excavation revealed one cultural feature, an occupation surface with a dense bone concentration mixed with charcoal and fire-modified rocks.

ZONE 1

This zone, radiocarbon dated at ca. 600 B.P., corresponds to DU V, defined as a thin layer of alluvial slope wash and an organic litter mat covering the western half of the site. Present across the entire site, the deposit is easily traced by its pebbly matrix. The cultural assemblage is small, although considerably larger than that of Zone 4. Although numerous ephemeral streams have cut through this zone, excavators did discover two well-defined cultural features in the northern area of the site.

SUMMARY

The oldest deposit exposed at the site, the basal cobble layer (DU I) represents Columbia River gravels deposited on the 305 m terrace sometime prior to 7000 B.P. A bracketing date of 6800 B.P. is provided by the thick deposit of Mazama tephra and fine sand (DU IIa) contained within the overlying fan deposit of coarse sands and gravels (DU II). This series of loamy sands interspersed with coarse sands and gravels is thought to have been laid down in the microdrainage basins of a network of ephemeral stream channels.

Subsequently, overbank deposition of the river laid down a layer of loamy sand over this ash layer. Initial cultural occupation at the site occurs in this unit above the primary deposit of Mazama Ash and within DU III, a series of coarse, possibly alluvial sands that contains pockets of redeposited Mazama Ash. Artifacts are sparse and no cultural features were recognized. Radiocarbon dates on cultural material of 4395±106 B.P. and 4590±143 B.P. date the renewed overbank deposition after about 5000 B.P., and indicate either that the river base level had not fallen far below the 305 m (1,000 ft) terrace or that there was a general increase in effective precipitation and river load. Overbank deposition during the period from 5000-1500 B.P. correlates with a period of increased precipitation and renewed overbank

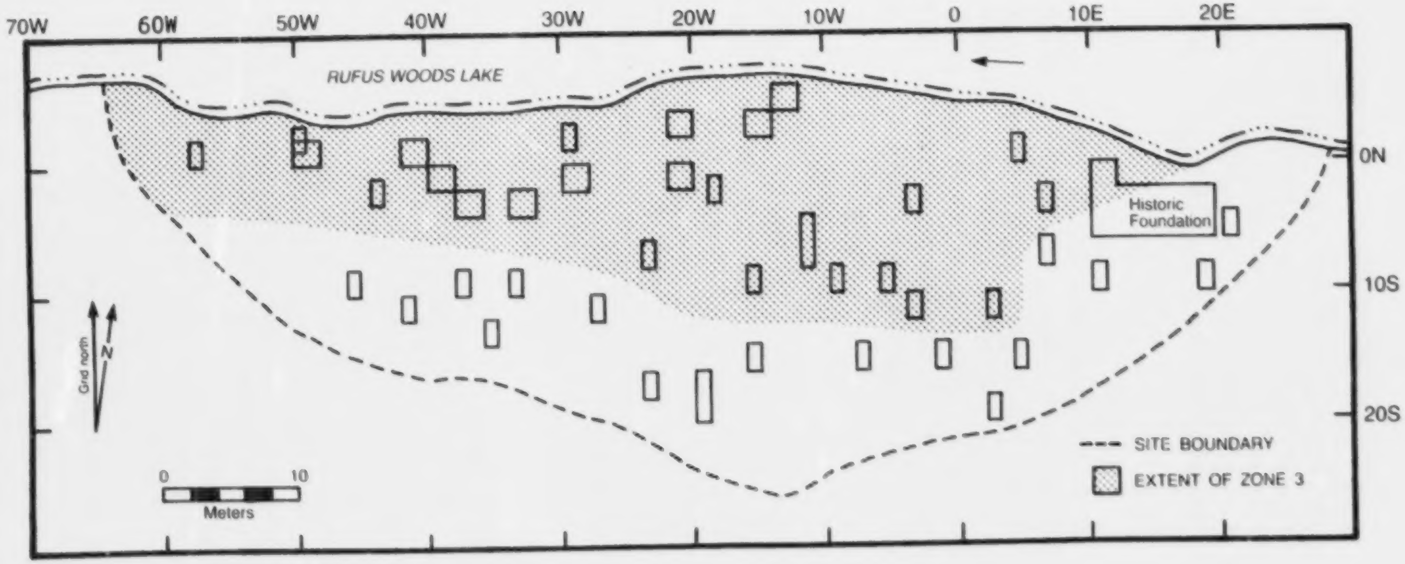

70W
60W
50W
40W
30W
20W
10W
0
10E
20E
0N
10S
20S
RUFUS WOODS LAKE
Historic Foundation
Grid north
N
0
10
Meters
SITE BOUNDARY
EXTENT OF ZONE 3

Figure 2-9. Extent of Zone 3, 45-DO-204.

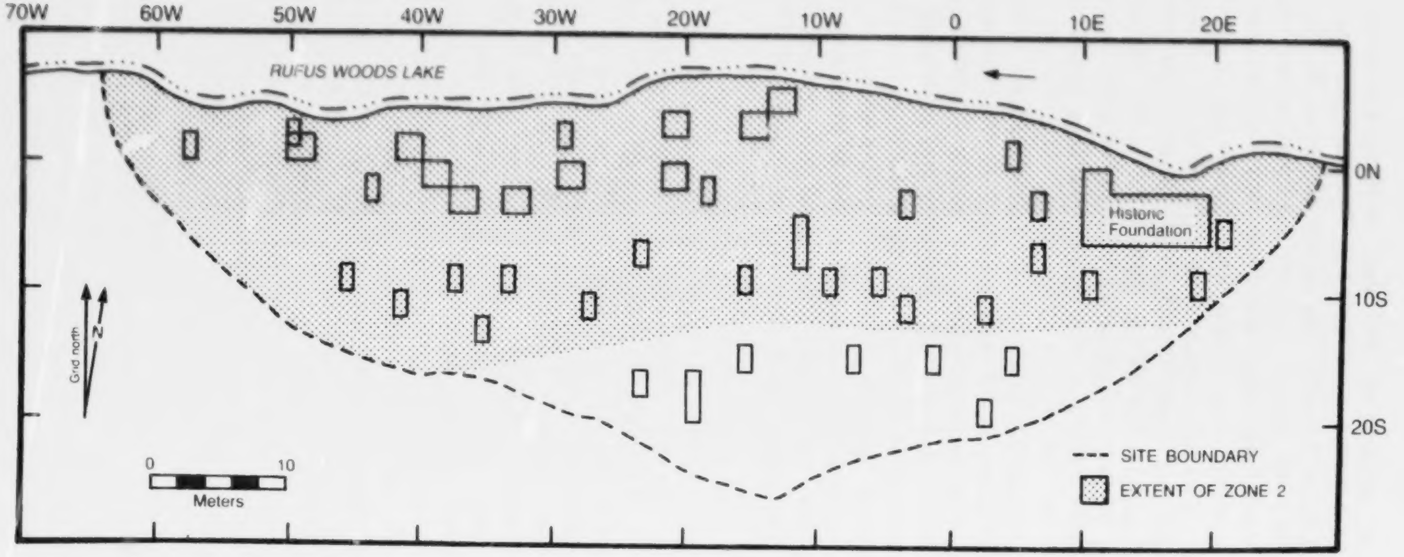

70W
60W
50W
40W
30W
20W
10W
0
10E
20E
0N
10S
20S
RUFUS WOODS LAKE
Historic Foundation
Grid north
N
0
10
Meters
SITE BOUNDARY
EXTENT OF ZONE 2

Figure 2-10. Extent of Zone 2, 45-DO-204.

sedimentation following an episode of decreased effective precipitation (7500-4500 B.P.) (cf., Hansen 1947) noted by Fryxell (1973) for the Wells Reservoir area. At ca. 4500-4300 B.P., a firepit was constructed in DU IV, Analytic Zone 3, a zone which yielded the second largest cultural assemblage embodied in loose scatters of fire-modified rock and other artifactual debris. The upper sand strata are a mixture of overbank and slope wash or stream deposits. A radiocarbon date of 2812±344 B.P. taken from fine alluvial overbank deposits in DU IV record continued river level fluctuation after about 3000 B.P. Associated with overbank deposition at ca. 2800 B.P. is the largest cultural assemblage from the site, Zone 2, comprising a large, charcoal-stained activity surface strewn with fire-modified rocks, various stone tools, and butchered bone.

After this time and sometime prior to ca. 1000-500 B.P., overbank deposition ceased, and sediments were laid down primarily by slope wash, stream action, and aeolian processes. DU V, a thin layer of alluvial slope wash and a covering organic litter matter, contains the uppermost cultural assemblage (Analytic Zone 1), which is marked by a partially destroyed earth oven radiocarbon dated at ca. 600-500 B.P. and characterized by diffuse scatters of artifacts. We have no evidence that the historic floods of 1894 and 1948 inundated 45-DO-204: by 1500 B.P. the river had probably downcut far enough that its fluctuations no longer disturbed the site.

3. ARTIFACT ANALYSIS

Artifacts from site 45-DO-204 have been subjected to three separate analyses: technological, functional, and stylistic. Technological analysis describes elements of tool manufacture, outlining constraints imposed by specific materials and making correlations between tool types and materials. It emphasizes the identification of lithic reduction sequences at the site. Functional analysis describes wear attributes on tools and makes inferences from these about the use of tools on raw materials. Stylistic analysis describes morphological elements of demonstrated temporal and spatial significance, and defines types that can be related to established cultural types or complexes. Together, these analyses provide a basic description of the artifacts and highlight points of particular interest.

The three analyses focus on the description of stone artifacts. Other materials enter the classification only when they exhibit specified characteristics. For example, bone and shell are classified according to manufacture and wear but fall outside of dimensions like edge angle. Further, we subject some artifact classes to detailed comparative analyses because prior researchers have considered them diagnostic. Other classes are simply described within the established framework. In this way, we are able to compare our analyses of the assemblages of the sites within the project area to each other, as well as to the analyses carried out by other researchers.

These analyses take the form of paradigmatic classifications as defined by Dunnell (1971b, 1979). Attributes are selected that describe the collection's morphological variation. These attributes correspond to defined stages of tool manufacture, characterize specific tool uses, and indicate limited periods of time. We combine them into two sets: features--attributes that describe morphological variation in the artifact assemblage without reference to cultural origin; and modes--attributes that represent cultural activity. During analysis, we identify each artifact with a single feature or mode that characterizes it. By organizing the features and modes into larger associations, termed dimensions, and by cross-tabulating them, we can form sets of comparable but mutally exclusive classes. From study of these classes, we may draw inferences concerning the nature of tool manufacture and use. Diagnostic specimens can be identified when temporal and spatial distributions fall into discrete patterns.

Technological and functional artifact classes are descriptive, detailing aspects of form indicative of manufacture and use. Stylistic classes, however, are both descriptive and historical, descriptive because they categorize variation in artifact form, and historical because they can often be related to known chronologies. The descriptive and historical types defined here are arbitrary constructs designed to clarify the temporal and spatial distribution of artifacts both within the site and within the surrounding study area. They are best-fit devices, enabling the author to deploy a large body of data in an orderly manner.

In the following subsections we present the descriptive data generated during technological, functional, and stylistic analyses. The bulk of data is summarized in tables, with text reserved for discussion and interpretation of major points. At the beginning of each subsection, we briefly describe dimensions used in each analysis. The tables list the attributes corresponding to each dimension. In our discussion, we will trace major themes in each subsection and link them to discernible trends in artifact distribution.

TECHNOLOGICAL ANALYSIS

In technological analysis, we consider morphological elements that indicate specific methods of tool manufacture. Researchers who have studied the stone tool production sequence have identified its salient characteristics (e.g., Crabtree 1967a, 1967b, 1972; Flenniken and Garrison 1975; Muto 1976, 1971; Smith and Goodyear 1976; Speth 1972; Stafford 1979; Swanson 1975).

While the process of lithic reduction may vary greatly even within defined industries, an idealized trajectory of reduction, with certain fundamental steps, can be constructed. First, the knapper selects a nodule which will serve as a core for the production of flakes of suitable size and shape. The first flakes removed exhibit the weathered surface of the stone. Later flakes show little or no weathered surface, and may have flake scars from the initial flaking. All of these flakes may be removed with a hard hammer of stone, and this creates distinctive large flakes with pronounced bulbs of percussion, strong stress lines, and crushed striking platforms. Once flakes are of a suitable size, the knapper modifies them further with a soft hammer of antler or wood, producing smaller flakes with less pronounced bulbs of percussion, finer stress lines, and little or no crushing of the striking platforms. Later, after the artifact has been roughed out to the desired shape, the knapper may remove still smaller flakes with an antler tine to sharpen, finely shape, and maintain working edges on the tool.

This is, of course, an extreme simplification. Not only are there innumerable variations in the sequence of steps and tools used, there are also several related processes with distinctive steps and products. The above description characterizes a flake tool technology, wherein hammers of different materials are used to detach thin, lammellar flakes by direct percussion. There is a related blade industry, where hammers or punches are used to create long, narrow flakes with prismatic cross sections. This technique requires a more prepared core, and may involve indirect as well as direct percussion (cf., Leonhardy and Muto 1972; Muto 1976). In turn, these industries may be contrasted with the microblade industry which calls for the creation of small, carefully prepared wedge-shaped cores and use of fine fabricators for detachment of flakes. Very small, thin blades with one or more arrises are produced, which are in themselves finished tool forms requiring no further modification (cf., Sanger 1968, 1970). While clearly distinct, these three industries need not have been independent, as one could easily complement the others as part of a more comprehensive industry. That this is in fact the case is suggested by the presence of flake and blade industries in early assemblages on the Columbia Plateau (Leonhardy and Rice 1970; Leonhardy et al. 1971).

Artifact types are the best indicators of lithic industries (e.g., cores, blades and flakes, and tools made from blades or flakes). Core configuration is distinctive; flakes, blades, and microblades are also readily distinguished. Tools often evidence attributes of origin like arris remnants or striking platforms. Other characteristics, though quite recognizable, are less certain diagnostic indicators, and often blend into the general signposts of lithic reduction outlined above (e.g., detritus, flake size, presence or absence of cortex, etc.).

It would be helpful to define some terms. Cores are cobbles or nodules from which a series of flakes have been removed. Initial or primary flakes are those which retain cortex on their dorsal surfaces (opposite the bulb of percussion). Secondary flakes are those that do not have cortex on their dorsal surfaces. Blanks are flakes that have been roughed out into a uniform shape by the removal of flakes on the dorsal and ventral surfaces. A preform results from further reduction of the surface of the blank prior to final modification. Of course, a tool may be withdrawn from this reductive sequence at any stage. A primary or secondary flake may be utilized without further modification. A projectile point preform broken during notching may become a drill or perforator. A core can be converted into a scraper or flesher; or a larger core may be used as a chopper or hammer. The process is complex, but steps can be inferred from the distinctive forms and their morphological attributes.

Technological analysis makes use of five dimensions: OBJECT TYPE, MATERIAL, CONDITION, DORSAL TOPOGRAPHY, and TREATMENT. These describe the kind and condition of artifacts and the materials from which they are made. Descriptive attributes of WEIGHT, LENGTH, WIDTH, and THICKNESS are also measured, and supplement the classificatory dimensions. Table 3-1 lists these dimensions and attributes.

Since technological processes vary according to the raw material used, we will first describe the distribution of material types at the site. Object types, their condition, treatment, and the relationship of dorsal topography to other dimensions and metric attributes can then be considered. Dorsal topography and object type are particularly important in identifying stages in the reduction sequence. From the amount of cortex and size of flakes, we can make inferences about stages of reduction at the site. Object types recovered demonstrate end products of that sequence and document variation in the idealized trajectory of forms.

The material types found at 45-DO-204 were jasper, chalcedony, petrified wood, obsidian, quartzite, basalt, and granite. These designations, however, do not reflect standard geologic definitions; rather, they are "rule of thumb" appraisals (cf. Jermann et al. 1978). Table 3-2 records counts, weights in grams, and percentages of material types by analytic zone.

Table 3-1. Technological dimensions, 45-DO-204.

DIMENSION I: OBJECT TYPE

- Conchoidal flake
- Chunk
- Core
- Linear flake
- Unmodified
- Tabular flake
- Formed object
- Weathered
- Indeterminate

DIMENSION II: RAW MATERIAL*

- Jasper
- Chalcedony
- Petrified Wood
- Obsidian
- Quartzite
- Fine-grained quartzite
- Basalt
- Fine-grained basalt
- Granite
- Bone/antler
- Ochre
- Shell
- Indeterminate

DIMENSION III: CONDITION

- Complete
- Proximal fragment
- Proximal flake
- Less than 1/4 inch
- Broken
- Indeterminate

DIMENSION IV: DORSAL TOPOGRAPHY

- None
- Partial cortex
- Complete cortex
- Indeterminate/not applicable

DIMENSION V: TREATMENT

- Definitely burned
- Dehydrated (heat treatment)

ATTRIBUTE I: WEIGHT

Recorded weight in grams

ATTRIBUTE II: LENGTH

Flakes: length is measured between the point of impact and the distal end along the bulbar axis

Other: length is taken as the longest dimension

ATTRIBUTE III: WIDTH

Flakes: width is measured at the widest point perpendicular to the bulbar axis

Other: width is taken as the maximum measurement along an axis perpendicular to the axis of length

ATTRIBUTE IV: THICKNESS

Flakes: thickness is taken at the thickest point on the object, excluding the bulb of percussion and the striking platform

Other: thickness is taken as the measurement perpendicular to the width measurement along an axis perpendicular to the axis of length

* Only those raw materials recorded from 45-DO-204 are included.

Table 3-2. Counts and weights of material types by zone, 45-DO-204.

Material Type Col %	Zone								Total	
	1		2		3		4			
	#	gms	#	gms	#	gms	#	gms	#	gms
Jasper	322 55.8	1,643 5.2	491 47.8	1,963 10.5	426 46.1	2,208 3.0	71 48.6	146 0.7	1,310 49.0	5,933 4.1
Chaledony	173 30.0	455 1.4	201 19.6	636 3.5	199 21.5	617 0.8	29 19.8	112 0.5	602 22.5	1,820 1.2
Petrified wood	2 0.3	94 0.3	1 0.1	288 1.6	1 0.1	159 0.2	-	-	4 0.1	541 0.4
Obsidian	1 0.2	1 <0.1	2 0.2	49 0.3	1 0.1	1 <0.1	1 0.7	1 <0.1	5 0.2	52 <0.1
Fine-grained quartzite	20 3.5	455 1.4	11 1.1	49 0.3	25 2.7	7,485 10.0	6 4.1	12 <0.1	62 2.3	8,001 5.5
Coarse-grained quartzite	48 8.3	2,144 6.8	266 25.9	7,961 43.3	180 19.5	11,230 15.0	24 16.4	268 1.2	518 19.4	21,603 14.8
Fine-grained basalt	7 1.2	15 <0.1	50 4.9	476 2.6	61 6.6	1,482 2.0	14 9.6	15 <0.1	132 4.9	1,988 1.4
Basalt	3 0.5	18,216 58.0	4 0.4	106 0.6	27 2.9	26,372 35.3	-	-	34 1.2	44,694 30.6
Granitic	1 0.2	8,410 26.7	2 0.2	6,871 37.4	5 0.5	25,211 33.7	1 0.7	21,137 97.4	9 0.3	61,629 42.1
TOTAL	577 100.0	31,433 100.0	1,028 100.2	18,372 100.1	925 100.0	74,765 100.0	146 99.9	21,691 100.0	2,676 99.9	146,261 100.1

Materials show a relatively consistent distribution throughout the four analytic zones. Jasper and chalcedony predominate, together comprising over 70% of the total number of pieces and 5% of the total weight. Quartzite comprises over 20% of the total number and 20% of the total weight. Though basalt and granite occur in much lower frequencies, they constitute 72% of the total weight. Both petrified wood and obsidian are rare. The discrepancy between cryptocrystalline stones, which occur in the highest frequencies, and noncryptocrystalline stones, which occur in the highest weights, reflects inherent differences in the structural properties of these materials and the manner in which prehistoric man used them. Fine-grained, concholdally fracturing stones like jasper and chalcedony were more tractable, and easily worked into a wider range of smaller tools with fine cutting edges. Blockier, coarse-grained, nonconholdally fracturing stones like quartzite, basalt, and granite held a more limited potential for tool types, and were often worked less intensively or utilized in their natural form.

Frequencies and mean weights of pieces of stone can indicate different stages or kinds of tool manufacture. Numerous small flakes of concholdally fracturing stones suggest secondary steps in the reduction sequences at the site. Certainly, these materials were utilized differently than the basalts and granites. Quartzite, however, falls within the two extremes. Quartzite flakes are numerous and their weights comparatively low, but their frequencies are not as high nor their weights as low as those recorded for jasper and chalcedony. The smallest pieces are cryptocrystalline stones, the medium-sized are fine-grained but non-concholdally fracturing stones, and the largest are coarse-grained, non-concholdally fracturing stones. These distinctions occur throughout all four analytic zones, and may indicate separate technological processes aimed at the production of different kinds of tools from different material groups.

This is borne out by correlations between object types and material types (Table 3-3). Most concholdal flakes, linear flakes, and chunks are of cryptocrystalline stone. Tabular flakes are of a laminar quartzite (quartzosefeldspathic schist). The only core recovered was of the same material. Unmodified objects are predominantly of basalt and granite (unmodified cobbles and fire-cracked rocks are not defined as object types).

Concholdal flakes are the most common objects in the the collection (N=2,142, 76%). Tabular flakes (N=435, 15%) and chunks (N=216, 7%) constitute the majority of other object types. These types indicate that reduction occurred at the site; however, judging from the relative lack of cores, primary reduction may have gone on away from the site.

Table 3-4 records the distribution of flake size by material type throughout the four analytic zones. The majority of all specimens are > 1/4 in in size (N=2,817, 93%). Flakes < 1/4 in are comparatively rare (N=225, 7%). When sorted by material type, it is apparent that 90-100% of all zonal assemblages consist of flakes > 1/4 in in size, except for obsidian (N=5, 83%).

Table 3-5 presents debitage counts by material and analytic zone. As shown, the overwhelming majority of flakes are classified as secondary or

Table 3-3. Object type by material by zone, 45-DO-204.

Object Type	Zone				Total
	1	2	3	4	
Conchoidal Flake					
Jasper	301	418	370	68	1,157
Chalcedony	167	194	189	27	577
Petrified wood	1	–	–	–	1
Obsidian	1	1	1	1	4
Quartzite	3	33	27	2	65
Fine-grained quartzite	18	11	22	6	57
Basalt	–	4	22	–	26
Fine-grained basalt	7	48	57	13	125
Granitic	–	–	2	–	2
Indeterminate	19	46	47	16	128
Linear Flake					
Jasper	–	2	3	–	5
Chalcedony	1	2	–	–	3
Indeterminate	–	–	–	1	1
Tabular Flake					
Quartzite	41	223	148	21	433
Fine-grained quartzite	–	–	2	–	2
Chunk					
Jasper	21	70	53	3	147
Chalcedony	5	5	10	2	22
Petrified wood	1	1	1	–	3
Obsidian	–	1	–	–	1
Quartzite	3	10	4	1	18
Fine-grained quartzite	2	–	–	–	2
Basalt	1	–	2	–	3
Fine-grained basalt	–	2	4	1	7
Granitic	–	1	1	–	2
Indeterminate	1	7	2	1	11
Core					
Quartzite	–	–	1	–	1
Unmodified					
Fine-grained quartzite	–	–	1	–	1
Basalt	2	–	3	–	5
Granitic	1	1	2	–	4
Indeterminate	–	–	1	–	1
TOTAL	596	1,080	975	163	2,814

Table 3-4. Flake size by material and zone, 45-DO-204.

Material	Size	Zone				Total
		1	2	3	4	
Jasper	>1/4	322	491	426	71	1,310
	<1/4	19	59	48	9	135
Chalcedony	>1/4	173	201	199	29	602
	<1/4	27	15	16	4	62
Petrified wood	>1/4	2	1	1	–	4
Obsidian	>1/4	1	2	1	1	5
	<1/4	1	–	–	–	1
Quartzite	>1/4	47	266	180	24	517
	<1/4	2	8	3	–	13
Fine-grained quartzite	>1/4	20	11	25	6	62
	<1/4	–	–	1	1	2
Basalt	>1/4	3	4	27	–	34
Fine-grained basalt	>1/4	7	50	61	14	132
	<1/4	–	2	7	1	10
Granitic	>1/4	1	2	5	–	8
Mica	>1/4	–	–	1	–	1
Indeterminate	>1/4	21	54	49	18	142
	<1/4	1	1	–	–	2
TOTAL	>1/4	597	1,028	975	163	2,817
	<1/4	50	85	75	15	225

without cortex (N=2,200, 86%). Only 317 (13%) specimens have partial or whole cortex.

The distinction between primary and secondary flakes, representing different stages of lithic reduction sequences, is further clarified in Table 3-6, which lists conchoidal flake size by cortex, material, and analytic zone. All measurements are given in centimeters. Noncryptocrystalline flakes, it will be seen, are larger and thicker than cryptocrystalline flakes. Secondary flake size is very consistent from zone to zone, while primary flakes show much greater variation in size. This is probably due to variation in the raw materials themselves: some stones may be found as small, eroded nodules, others may occur as large veins or outcrops. Only when the original form has been reduced, or when flakes are made into tools or formed objects, is consistency in length, width, and thickness achieved.

When we classify defined object types by cortex, material, and analytic zone a pattern emerges similar to that observed for the debitage (Table 3-7). Most conchoidal flakes (N=2,033, 96%) and chunks (N=168, 87%) do not exhibit any cortex. This proportion changes somewhat with tabular flakes--only 346 specimens (81%) have no cortex. In sharp contrast, all the unmodified objects and linear flakes have some cortex. Conchoidal flakes with cortex are equally divided between cryptocrystalline (N=42, 50%) and noncryptocrystalline (N=42,

Table 3-5. Count of debitage by material by zone, 45-DO-204.

Material	Zone				Total
	1	2	3	4	
Cryptocrystalline					
Secondary	414	541	482	85	1,522
Primary	34	74	65	6	179
Indeterminate	5	7	5	–	17
Quartzite					
Secondary	29	201	127	18	375
Primary	11	47	44	6	108
Indeterminate	–	8	2	–	10
Fine-grained quartzite					
Secondary	16	11	18	6	51
Primary	3	–	–	–	3
Indeterminate	–	–	1	–	1
Basalt					
Secondary	7	44	65	12	128
Primary	–	4	10	1	15
Indeterminate	–	1	2	–	3
Obsidian					
Secondary	1	1	1	1	4
Granitic					
Primary	–	–	3	–	3
Indeterminate					
Secondary	19	44	43	14	120
Primary	1	6	2	–	9
Indeterminate	–	–	1	1	2
TOTAL	486	842	736	136	2,200
	49	131	124	13	317
	5	16	11	1	33

50%) stones. This suggests that primary reduction at the site involved a variety of material types, and did not focus on jasper and chalcedony. Interestingly, proportions of objects with cortex increase markedly in Zone 2 and Zone 3, perhaps indicating that during those periods more primary reduction was taking place (conchoidal flakes, 78%; linear flakes, 87%; tabular flakes, 83%; chunks 84%).

Table 3-8 lists the occurrence of heat treatment by analytic zone. While only 1.7% (N=47) of objects were classified as burned, 68% (N=32) of them were recovered from Zone 2. Object types, and their technological characteristics remain quite similar over time, but higher frequencies of cortex and heat treatment do indicate some variation in intensity or the type of production being practiced. Tables 3-2 and 3-3, which show fairly consistent distributions of material types throughout all analytic zones, demonstrate that this variation is not due to the materials being utilized. Table 3-9, which indicates the occurrence of heat treatment for each material type, by zone, bears out this conclusion.

Table 3-6. Measurements of conchoidally flaked material by zone.

Attributes	Zone				Total
	1	2	3	4	
Length (mm)					
No Cortex					
Cryptocrystalline					
$\bar{x}$	10.3	9.3	10.4	9.6	10.1
s.d.	5.7	4.4	5.9	3.0	5.2
n	160	203	197	34	594
Other					
$\bar{x}$	14.0	10.4	11.5	9.4	11.3
s.d.	8.3	4.5	7.4	4.4	6.5
n	21	46	48	13	128
Cortex					
Cryptocrystalline					
$\bar{x}$	24.0	14.7	31.7	15.0	21.4
s.d.	-	8.4	14.8	-	12.2
n	1	4	3	1	9
Other					
$\bar{x}$	26.0	23.6	23.2	0.0	23.6
s.d	2.8	18.7	13.3	-	14.4
n	2	7	10	-	19
Thickness (.1mm)					
No Cortex					
Cryptocrystalline					
$\bar{x}$	19.9	19.8	17.4	18.9	19.0
s.d.	13.8	14.8	12.0	10.8	13.5
n	160	203	196	34	593
Other					
$\bar{x}$	30.1	22.4	21.6	16.7	22.8
s.d.	19.7	13.5	17.3	13.6	16.4
n	21	46	49	13	129
Cortex					
Cryptocrystalline					
$\bar{x}$	41.0	28.0	75.3	56.0	48.3
s.d.	-	5.0	10.7	-	23.1
n	1	4	3	1	9
Other					
$\bar{x}$	66.0	64.0	69.3	40.0	55.6
s.d.	24.0	64.4	52.5	-	51.9
n	2	7	10	1	20
Width (mm)					
No Cortex					
Cryptocrystalline					
$\bar{x}$	9.3	9.3	9.4	9.0	9.3
s.d.	5.4	4.9	5.2	3.8	5.1
n	160	203	197	34	594
Other					
$\bar{x}$	14.2	12.0	12.1	9.5	12.1
s.d.	7.7	6.3	7.1	6.5	6.9
n	21	46	48	13	128
Cortex					
Cryptocrystalline					
$\bar{x}$	20.0	12.5	29.0	25.0	20.2
s.d.	-	3.8	10.4	-	9.7
n	1	4	3	1	9
Other					
$\bar{x}$	29.0	23.3	24.7	-	24.6
s.d.	12.7	14.9	16.3	-	14.8
n	2	7	10	-	19

Table 3-7. Count of object types by cortex, material and zone 45-DO-204.

Object Type	Zone				Total[1]
	1	2	3	4	
Conchoidal flake					
Cortex					
Cryptocrystalline	10	11	17	4	42
Other	3	14	24	1	42
No cortex					
Cryptocrystalline	454	593	536	91	1,674
Other	45	128	150	36	359
Linear flake					
Cortex					
Cryptocrystalline	1	4	3	–	8
Other	–	–	–	1	1
Blade					
Cortex					
Cryptocrystalline	–	1	–	–	1
Tabular knife					
Cortex					
Other	32	183	114	17	346
No cortex					
Other	9	32	34	4	79
Chunk					
Cortex					
Cryptocrystalline	1	5	1	–	7
Other	3	11	5	–	19
No cortex					
Cryptocrystalline	23	68	60	5	156
Other	3	10	5	3	21
Core					
No cortex					
Other	–	–	1	–	1
Unmodified					
No cortex					
Other	3	–	7	–	10
TOTAL	587	1,060	957	162	2,766

[1] Does not include <1/4 in flakes.

Table 3-8. Count of heat treatment by zone.

Heat Treatment Col %	Zone 1	Zone 2	Zone 3	Zone 4	Total
None	590 98.8	1,050 97.0	969 99.4	161 98.8	2,770 98.3
Burned	7 1.2	32 3.0	6 0.6	2 1.2	47 1.7

Table 3-9. Heat treatment by material type by zone, 45-DO-204.

Material Type	Zone 1	Zone 2	Zone 3	Zone 4	Total[1]
Jasper	6	22	5	1	34
Chalcedony	1	6	1	–	8
Fine-grained basalt	–	2	–	–	2
Indeterminate	–	2	–	1	3
TOTAL	7	32	6	2	47

[1] Material types with no heat-treatment specimens have been excluded.

Distributions of material types, object types, and attributes of dorsal topography indicate at least four separate technological processes aimed at the production of different kinds of tools from different stones. The pervasive industry was focused on the reduction of cryptocrystalline and fine-grained noncryptocrystalline stones into a wide variety of small uniform flakes, and fewer remnants of cortex. A related, but distinct, industry produced small, fine linear flakes on cryptocrystalline stones. Another industry used laminar quartzites, producing distinctive tabular flakes with less surface reduction and more cortex. The fourth industry produced large cutting, pounding, and grinding tools on large nodules of coarse-grained noncryptocrystalline materials, and created fewer and larger primary flakes, with little or no reduction, and more extensive cortex remnants. Evidence for all but the last industry is found throughout all four analytic zones. This last industry does not occur in Zone 4, which yielded the smallest cultural assemblage.

The tractable character of cryptocrystalline and fine-grained noncryptocrystalline stones formed the basis of an extensive flake tool technology, and resulted in object types representing all stages of the idealized reductive sequence. Most objects, as well as the greater part of the debitage, evidence this industry. Initially reduced by percussion flaking, these stones were easily fashioned into various tool forms, ranging from simple flakes with little or no surface reduction to finely shaped tools with significant or complete surface reduction. Jasper and chalcedony formed the basis of this production, and probably were transported as handy chunks, cores, or preforms to the site from nearby sources.

Microblade industries also utilized cryptocrystalline stones to manufacture small blades. The production of these "microblades" required a special core preparation. Striking platforms had to be broad and flat, with angular margins that approached a 90 degree or sub-90 degree angle to the striking platform. The knapper detached the blades either through indirect percussion with a punch, or through pressure flaking. The knapper directed this force to a circumscribed point on the platform, thus drawing the blade off the face of the core. Such blades would feather out as the force carried across the core's lateral surface or would terminate at some irregularity. Consistent flaking would produce series of long, narrow flake scars along the lateral surface, defined by long, narrow ridges or arrises. As reduction continued, new arrises would be formed on the dorsal surfaces of blades, running the length of the flake parallel to the lateral margins. While this industry differs from that used to create conchoidal flakes, the two industries are also linked, since cores or chunks that are products of one process can be readily adapted to the other.

The category **linear flake** was created to identify possible microblades. Flakes placed in this category are parallel-sided and approximately twice as long as they are wide. Width is less than one cm. Table 3-10 lists measurements of the seven linear flakes recovered from site 45-DO-204. These dimensions are quite similar to those of microblades recorded by Munsell (1968) and Sanger (1968, 1970). Blade configuration and proportions are well within the established parameters, and match attributes recorded for the 45-DO-282 assemblage from the project area which has a more complete industry containing microblade cores as well as high numbers of microblades (Lohse 1984d).

Table 3-10. Linear flake measurements, 45-DO-204.

Master Number	Number of Arrises	Length (mm)	Width (mm)	Thickness (mm)	Zone
652	2	13	6	1	3
179	2	12	6	1	2
611	2	11	4	1	2
230	2	9	5	1	1
651	1	9	3	1	3
656	1	9	3	1	3
198	2	7	4	1	2
	Range	7-13	3-6	–	
	$\bar{x}$	10	4.4	1	
	s.d.	2.1	1.3	–	

Laminar quartzites were reduced to produce thick, tabular flakes, which could be used without further modification. Actually a feldspathic schist, this stone fractures in tabular planes. It was reduced by fracturing the rock with a hammerstone; the resulting flakes would either be used or further reduced. The reduction of these quartzite cobbles found in the Columbia River gravels by the site was a practical industry commonly engaged in throughout the 4,500 years of site occupation.

Other coarse-grained noncryptocrystalline stones, predominantly basalt and granite, formed the basis of yet another industry. This was focused on reduction of materials available on the site surface or along the terraces bordering the Columbia River. Cobbles were reduced for the task at hand. The knapper would remove a series of flakes along a margin, either unifacially or bifacially, and create a heavy cutting tool, or he might peck the surface or margins of the cobble and so create a grinding or abrading tool. Unmodified cobbles were used as hammerstones to produce other tools or to pound and crush plant or animal materials in conjunction with anvils.

Thus, lithic reduction at the site over the course of human occupation encompassed the manufacture of various small flaked tools and larger tabular and cobble forms. The method of reduction depended on the material types at hand and the form of the desired tool. The manufacture of some tools required the transport of cryptocrystalline stones to the site, others required nothing more than the quick reduction of locally available cobbles. High frequencies of secondary flakes and debitage on the site document resharpening and finishing activities, while the single core and primary flakes evidence initial reduction of nodules and cobbles of cryptocrystalline and noncryptocrystalline stones.

The most frequent products were conchoidal flakes and tabular flakes, although a number of by-products like chunks and cores are present. Unmanufactured tools are common, although not plentiful. Perhaps the most significant trend documented in the tables is a marked increase in object types in Zones 2 and 3, in particular, higher frequencies of noncryptocrystalline conchoidal flakes and tabular flakes. Higher numbers of cryptocrystalline linear flakes and chunks accompany this increase. While containing reduction sequences characteristic of all four occupation layers, these two zones were probably the scene of either more intensive activity or a different focus of activity. In any case, tool manufacture in these zones produced distinctive object types that may indicate a broader economic focus that made use of a different range of functional tool forms. This topic will be explored in the following section.

FUNCTIONAL ANALYSIS

Functional analysis examines the physical characteristics of artifacts in order to identify patterns of wear diagnostic of specific tool uses. Past research has shown that tool use may be inferred by examining edge damage and general attrition of working surfaces (e.g., Crabtree 1973; Frison 1968; Hayden 1979; Keeley 1978, 1974; Odell 1977; Semenov 1964; Stafford and Stafford 1979; Wilmsen 1970, 1968). Wear patterns indicate both the manner of tool use (cutting, scraping, grinding, pounding) and the nature of the materials worked (bone, flesh, hides, seeds).

All artifacts were examined with a 10X hand-lens (cf. Hayden 1979; Stafford and Stafford 1979). During analysis, each artifact was classified as to tool shape, wear or surface damage, and edge angle. Making use of established correlations (e.g., Semenov 1964; Wilmsen 1968, 1970) between specific wear patterns on certain materials and types of tool use, we can hypothesize the general use of collected tools. Most distinctions will be based on the nature of edge attrition, given the relative hardness of the worked material.

Ten classificatory dimensions are used to describe functional attributes: UTILIZATION-MODIFICATION, TYPE OF MANUFACTURE, MANUFACTURE DISPOSITION, CONDITION OF WEAR, WEAR/MANUFACTURE RELATIONSHIP, KIND OF WEAR, LOCATION OF WEAR, SHAPE OF WORN AREA, ORIENTATION OF WEAR, and EDGE ANGLE. The first three dimensions describe objects, while the next six describe tools on objects. The last dimension describes variation within object/tool types through measurement of the working edges. Table 3-11 outlines these dimensions and attributes.

The discussion of the object-specific dimensions will focus on functional object types, and consider the occurrences of wear on them. Our discussion of the tool-specific dimensions will probe the relationship of wear to manufacture and explain the kinds of wear observed. Thus, our analysis will proceed from the object to examination of tools on the object. This distinction between formal types and tools must be made if we are to gauge an object's range of uses.

Table 3-12 shows the relationship between functional object types, wear-manufacture, and type of manufacture for formed objects (those that have been shaped for a specific use or to a common form) and for modified objects (those that have not been shaped to any extent, although these may exhibit resharpening of an edge or surface).

With the sole exception of a shaft abrader, all formed objects were made by chipping (N=56, 98%). The shaft abrader was coded as indeterminate because it is made of a vesicular scoria of glassy crystalline structure, which does not readily retain manufacturing characteristics. Examination by the author, under 20X and 40X magnification, revealed a smoother, abraded texture along the surface of the trough. This contrasts to the outer vesicular surfaces which show no evidence of intentional modification. We could not determine if that trough was created by manufacture or wear, though we suspect that it was the product of both, like most of the recovered formed objects (N=36, 68%).

The modified objects consist of several traditional functional types, including a drill and three tabular knives, as well as simple utilized forms. Most specimens exhibit no evidence of manufacture (N=143, 67%). Others were partially modified by chipping (N=62, 29%) or coded as indeterminate (N=8, 4%). Only 19% (N=41) of the modified objects exhibit a combination of wear and manufacture. The rest, predictably, show wear only along cutting edges or working surfaces.

Table 3-11. Functional dimensions, 45-DO-204.

DIMENSION I: UTILIZATION/MODIFICATION

- None
- Wear only
- Manufacture only
- Manufacture and wear
- Modified/indeterminate
- Indeterminate

DIMENSION II: TYPE OF MANUFACTURE

- None
- Chipping
- Pecking
- Grinding
- Chipping and pecking
- Chipping and grinding
- Pecking and grinding
- Chipping, pecking, grinding
- Indeterminate/not applicable

DIMENSION III: MANUFACTURE DISPOSITION

- None
- Partial
- Total
- Indeterminate/not applicable

DIMENSION IV: WEAR CONDITION

- None
- Complete
- Fragment

DIMENSION V: WEAR/MANUFACTURE RELATIONSHIP

- None
- Independent
- Overlapping - total
- Overlapping - partial
- Independent - opposite
- Indeterminate/not applicable

DIMENSION VI: KIND OF WEAR

- Abrasion/grinding
- Smoothing
- Crushing/pecking
- Polishing

DIMENSION VI: Continued

- Feathered chipping
- Feathered chipping/abrasion
- Feathered chipping/smoothing
- Feathered chipping/crushing
- Feathered chipping/polishing
- Hinged chipping
- Hinged chipping/abrasion
- Hinged chipping/smoothing
- Hinged chipping/crushing
- Hinged chipping/polishing
- None

DIMENSION VII: LOCATION OF WEAR

- Edge only
- Unifacial edge
- Bifacial edge
- Point only
- Point and unifacial edge
- Point and bifacial edge
- Point and any combination
- Surface
- Terminal surface
- None

DIMENSION VIII: SHAPE OF WORN AREA

- Not applicable
- Convex
- Concave
- Straight
- Point
- Notch
- Slightly convex
- Slightly concave
- Irregular

DIMENSION IX: ORIENTATION OF WEAR

- Not applicable
- Parallel
- Oblique
- Perpendicular
- Diffuse
- Indeterminate

DIMENSION X: OBJECT EDGE ANGLE

- Actual edge angle

Table 3-12. Wear/manufacture and type of manufacture of formed and modified objects by zone, 45-DO-204.

Type	W/M[1]	M/T[2]	Zone				Total
			1	2	3	4	
Formed Objects							
Projectile point	M	C	1	–	–	–	1
	WM	C	–	1	–	–	1
base	WM	C	–	–	1	–	1
tip	M	C	1	2	–	1	4
	WM	C	1	–	–	–	1
Biface	M	C	–	5	2	–	7
	WM	C	2	–	1	–	3
Chopper	M	C	–	–	4	–	4
	WM	C	1	1	6	–	8
Drill	WM	C	–	1	–	–	1
Graver	WM	C	–	1	2	–	3
Scraper	WM	C	–	2	1	–	3
Shaft abrader	MI	I	–	–	1	–	1
Tabular knife	WM	C	6	5	4	–	15
TOTAL			12	18	22	1	53
Modified Objects							
Drill	W	N	–	–	1	–	1
Tabular knife	W	N	–	1	2	–	3
Linear flake	N	N	1	4	3	1	9
	W	N	–	1	–	–	1
Resharpening flake	W	N	2	–	2	–	4
	M	C	2	1	3	–	6
	WM	C	1	1	–	–	2
Bifacially retouched flake	M	C	–	6	2	–	8
	WM	C	4	3	4	–	11
Unifacially retouched flake	M	C	3	1	2	–	6
	WM	C	2	14	10	–	26
	I	C	–	–	1	–	1
Utilized flake	W	N	26	35	49	9	119
	WM	C	–	2	–	–	2
Hammerstone	W	N	3	–	2	–	5
Indeterminate	W	N	–	1	–	–	1
	MI	I	–	2	2	2	6
	I	I	–	2	–	–	2
TOTAL			44	74	83	12	213

Codes:

[1] Wear/Manufacture
W – Wear only
M – Manufacture only
WM – Wear and Manufacture
MI – Modified/Indeterminate
I – Indeterminate

[2] Manufacture Type
N – None
C – Chipping
I – Indeterminate

Table 3-13 shows numbers of wear areas on objects in each traditional functional category. At this point, functional analysis is tool-specific, with each occurrence of wear on only one object described separately. For example, a biface may have several areas of wear, indicating similar or distinct uses. These wear areas are determined on the basis of perceived separation--if wear is continuous along a surface or edge, it is considered one area; if, however, wear areas appear separated by a stretch of unworn edge or surface, they are considered separate tools. The table shows the number of wear areas per object, the number of objects per wear area, the ratio of number of wear areas to object types, and tabulation of these by analytic zone.

Drills, gravers, scrapers, tabular knives, hammerstones, and unifacially retouched flakes have the largest wear area ratios. Projectile point bases and blades also exhibit high ratios; however, since these categories contain only one specimen each, any assessment would be ill-advised. Because we lack a large assemblage of artifacts, this qualification applies somewhat to the larger classes; frequencies, however, are still sufficient for tentative inferences to be made.

Frequency distributions and wear area:object ratios across analytic zones do indicate a fairly even distribution of functional forms and tool uses over time, at least through Zones 1, 2, and 3 which contain 95% of the object types listed (N=237). The most common tool forms in the collection are conchoidal and tabular flakes. Of these, the highest wear area:object ratios occur on tabular flakes (1.72), unifacially retouched flakes (1.70) and simple utilized flakes (1.61); these are much lower ratios than those established for some of the more infrequent formal types. Interestingly, resharpened and bifacially retouched flakes have low average ratios (.29:.75). Further, most of these forms (N=7, 100%; N=16, 80%) and utilized flakes (N=79, 65%) have only one or no areas of wear. This indicates that these tools were used for a single task, and were discarded when the cutting edge dulled, to be replaced by other conchoidal flakes as the occasion demanded. To be sure, some conchoidal flakes were reused, as indicated by the numerous wear areas on utilized flakes, and bifacially and unifacially retouched flakes.

Table 3-14 summarizes functional analysis tool-specific data. KIND OF WEAR, and LOCATION OF WEAR. Grouped EDGE ANGLES are listed for each functional object type, and tabulated by analytic zone. Most dimensions and attributes require little explanation. LOCATION OF WEAR, however, merits some comment. "Edge only" wear is confined to the object's cutting edge, and does not extend onto any adjoining surface. "Point only" wear is highly concentrated, and does not extend along adjoining edges or surfaces. "Surface" wear does not extend beyond the surface. If a bifacially retouched object has wear on only one face of the edge, the location is identified as "unifacial edge." Conversely, a unifacially retouched object with wear on both manufactured and unmanufactured faces of the edge will be classified as "bifacial edge." EDGE ANGLE is listed in arbitrary 30 degree intervals.

This analysis bears out assumptions implicit in the determination of functional object types. Traditional functional types do correspond to certain kinds of uses. Smaller tools exhibit combinations of smoothing and

Table 3-13. Functional type and wear areas, 45-DO-204.

Traditional Functional Type	Number of Wear Areas	Zone								Wear/Area Ratio
		1		2		3		4		
		Freq	Ratio	Freq	Ratio	Freq	Ratio	Freq	Ratio	
Projectile point	0	1	0/1 =0.00	0	1/1 =1.00	0		0		1/2 =0.50
	1	0		1		0		0		
	2	0		0		0		0		
Projectile point tip	0	1	1/2 =0.50	2	0/2 =0.00	0		1	0/1 =0.00	1/5 =0.20
	1	1		0		0		0		
Projectile point base	0	0		0		0	2/1 =2.00	0		2/1 =2.00
	1	0		0		0		0		
	2	0		0		1		0		
Biface	0	0	3/2 =1.50	5	0/5 =0.00	2	5/3 =1.66	0		8/10 =0.80
	1	1		0		0		0		
	2	1		0		0		0		
	5	0		0		1		0		
Chopper	0	0	1/1 =1.00	0	0/1 =0.00	4	11/10 =1.1	0		12/12 =1.00
	1	1		1		4		0		
	2	0		0		0		0		
	3	0		0		1		0		
	4	0		0		1		0		
Drill	0	0		0	1/1 =1.00	0	2/1 =2.00	0		3/2 =1.50
	1	0		1		0		0		
	2	0		0		1		0		
Graver	0	0		0	1/1 =1.00	0	4/2 =2.00	0		5/3 =1.66
	1	0		1		1		0		
	3	0		0		1		0		
Scraper	0	0		0	7/2 =3.50	0	3/1 =3.00	0		10/3 =3.33
	3	0		1		1		0		
	4	0		1		0		0		
Tabular knife	0	0	10/6 =1.67	0	11/6 =1.83	0	10/6 =1.67	0		31/18 =1.72
	1	3		3		3		0		
	2	2		1		2		0		
	3	1		2		1		0		
Hammerstone	0	0	7/3 =2.3	0		0	5/2 =2.50	0		12/5 =2.4
	1	2		0		1		0		
	2	0		0		0		0		
	4	0		0		1		0		
	5	1		0		0		0		
Blade	2	0		1	2/1 =2.00	0		0		2/1 =2.00
Linear flake	0	1	0/1 =0.00	4	0/4 =0.00	3	0/3 =0.00	1	0/1 =0.00	0/9 =0.00
Resharpening flake	0	0		1	1/2 =0.50	3	1/5 =0.20	0		2/7 =0.29
	1	0		1		2		0		
Bifacially retouched flake	0	2	3/5 =0.60	6	3/9 =0.33	2	9/6 =1.5	0		15/20 =0.75
	1	3		3		0		0		
	2	0		0		3		0		
	3	0		0		1		0		
	4	0		0		0		0		

Table 3-13. Cont'd.

Traditional Functional Type	Number of Wear Areas	Zone								Wear/Area Ratio
		1		2		3		4		
		Freq	Ratio	Freq	Ratio	Freq	Ratio	Freq	Ratio	
Unifacially retouched flake	0	3	4/5	1	35/15	2	17/13	0		56/33
	1	1	=0.80	3	=2.33	8	=1.31	0		=1.7
	2	0		6		0		0		
	3	1		2		3		0		
	4	0		2		0		0		
	6	0		1		0		0		
Utilized flake	0	0	33/26	0	62/37	0	86/49	0	14/9	195/121
	1	21	=1.27	24	=1.67	28	=1.75	6	=1.55	=1.61
	2	3		7		11		2		
	3	2		3		7		0		
	4	0		2		1		1		
	5	0		0		1		0		
	6	0		0		1		0		
	7	0		1		0		0		
Indeterminate	0	0		3	2/5	2	0/2	2	0/2	2/9
	1	0		2	=0.40	0	=0.00	0	=0.00	=0.22

feathered chipping wear on edges and points, indicating light cutting, scraping and perforating uses. Projectile points (100%), tabular knives (81%), resharpened flakes (66%), and bifaces (63%) consistently show smoothing wear, often in combination with feathered chipping. Linear flakes (100%), drills (66%), utilized flakes (64%), and unifacially retouched flakes (34%) commonly have feathered chipping wear. Other small tools exhibit combinations of smoothing and hinged chipping wear on edges and points, indicating heavier cutting, scraping, and perforating uses. Gravers (100%), scrapers (70%), bifacially retouched flakes (55%), unifacially retouched flakes (50%), and utilized flakes (29%) commonly have hinged chipping wear. Larger tools generally exhibit crushing or pecking wear, indicating much heavier cutting and pounding uses. Hammerstones (100%) and choppers (62%) show massive attrition of edges and surfaces, classified as crushing of an edge or crushing of a surface. Plate 3-1 illustrates gravers, bifaces, and drills, while Plate 3-2 illustrates cobble tool types.

We may also infer that specific functional object types were used for a variety of purposes, not necessarily implied by the functional type labels. Projectile points were multipurpose tools, with wear indicating cutting and scraping uses, resembling those of bifaces, linear flakes, tabular knives, resharpened, retouched and utilized flakes. Tabular knives exhibit predominantly smoothing wear on edges, as well as feathered chipping and hinged chipping, which indicates light scraping-cutting use on soft, pliable materials, as well as cutting or cleaving functions. Not unexpectedly, evidence for more varied uses occurs on unifacially and bifacially retouched, and utilized flake tools. All three forms show smoothing, feathered chipping, hinged chipping, and combinations thereof, indicating a range of uses on soft

Table 3-14. Formal type and wear area paradigm, 45-DO-204.

Type Wear	Zone				Total
	1	2	3	4	
Projectile point					
Kind of Wear					
Smoothing	–	1	–	–	1
Feathered chipping/smoothing	1	–	2	–	3
Location of Wear					
Unifacial edge	–	–	1	–	1
Bifacial edge	–	–	1	–	1
Point any edge combination	1	1	–	–	2
Grouped Edge Angle					
31-60 degrees	1	1	2	–	4
Biface					
Kind of Wear					
Feathered chipping/smoothing	1	–	4	–	5
Hinged chipping	1	–	–	–	1
Hinged chipping/smoothing	1	–	1	–	2
Location of Wear					
Unifacial Edge	2	–	5	–	7
Bifacial Edge	1	–	–	–	1
Grouped Edge Angle					
1-30 degrees	–	–	1	–	1
31-60 degrees	3	–	3	–	6
>60 degrees	–	–	1	–	–
Chopper					
Kind of Wear					
Smoothing	1	–	2	–	3
Crushing/pecking	–	–	6	–	8
Hinged chipping/smoothing	–	1	1	–	2
Location of Wear					
Edge only	1	–	1	–	2
Bifacial edge	–	1	3	–	4
Point only	–	–	1	–	1
Surface	–	–	1	–	1
Terminal surface	–	–	5	–	5
Grouped Edge Angle					
31-60 degrees	–	–	1	–	1
>60 degrees	1	1	4	–	6
Surface	–	–	6	–	6
Drill					
Kind of Wear					
Feathered chipping	–	–	1	–	1
Feathered chipping/smoothing	–	1	–	–	1
Hinged chipping/smoothing	–	–	1	–	1
Location of Wear					
Unifacial edge	–	–	1	–	1
Point and two edges	–	1	1	–	2
Grouped Edge Angle					
1-30 degrees	–	–	1	–	1
31-60 degrees	–	1	–	–	1
Indeterminate	–	–	1	–	1
Graver					
Kind of Wear					
Hinged chipping/smoothing	–	1	4	–	5
Location of Wear					
Unifacial Edge	–	–	2	–	2
Point any edge combo	–	1	2	–	3
Grouped Edge Angle					
>60 degrees	–	1	3	–	4
Indeterminate	–	–	1	–	1

Table 3-14. Cont'd.

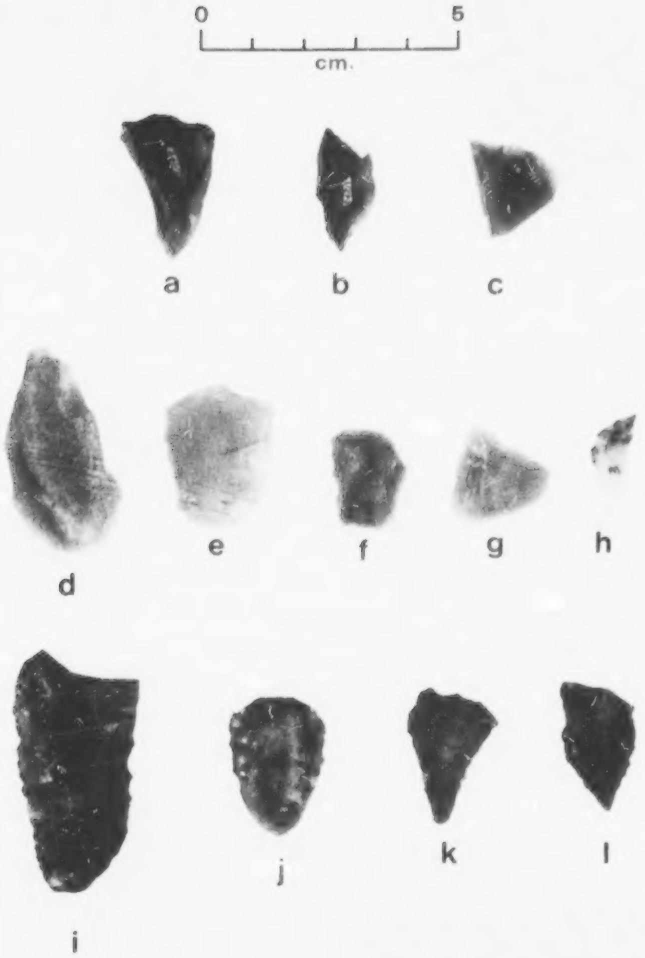
Type Wear	Zone				Total
	1	2	3	4	
Scraper					
Kind of Wear					
Feathered chipping	–	1	1	–	2
Hinged chipping	–	5	2	–	7
Hinged chipping/smoothing	–	1	–	–	1
Location of Wear					
Unifacial edge	–	7	3	–	10
Grouped Edge Angle					
31-60 degrees	–	1	2	–	3
>60 degrees	–	6	1	–	7
Tabular knife					
Kind of Wear					
Smoothing	10	8	7	–	25
Feathered chipping	–	–	1	–	1
Feath chipping/smoothing	–	1	2	–	3
Hinged chipping/smoothing	–	2	–	–	2
Location of Wear					
Edge only	10	8	7	–	25
Unifacial edge	–	3	2	–	5
Bifacial edge	–	–	1	–	1
Grouped Edge Angle					
1-30 degrees	3	2	2	–	7
31-60 degrees	7	6	6	–	19
>60 degrees	–	3	2	–	5
Hammerstone					
Kind of Wear					
Crushing/pecking	7	–	6	–	13
Location of Wear					
Terminal surface	7	–	6	–	13
Grouped Edge Angle					
Surface	7	–	6	–	13
Linear flake					
Kind of Wear					
Feathered chipping	–	2	–	–	2
Location of Wear					
Bifacial edge	–	2	–	–	2
Grouped Edge Angle					
1-30 degrees	–	2	–	–	2
Resharpening flake					
Kind of Wear					
Feathered chipping	1	–	1	–	2
Feath chipping/smoothing	2	1	1	–	4
Location of Wear					
Unifacial edge	1	–	2	–	3
Bifacial edge	2	1	–	–	3
Grouped Edge Angle					
31-60 degrees	1	1	–	–	2
>60 degrees	2	–	2	–	4
Bifacially retouched flake					
Kind of Wear					
Smoothing	–	1	–	–	1
Feath chipping	3	–	3	–	6
Feath chipping/smoothing	–	–	1	–	1
Hinged chipping	5	1	5	–	11
Hinged chipping/smoothing	1	1	–	–	2
Location of Wear					
Unifacial edge	8	–	8	–	16
Bifacial edge	1	3	1	–	5

Table 3-14. Cont'd.

Type Wear	Zone				Total
	1	2	3	4	
Bifacially retouched flake cont'd					
Grouped Edge Angle					
1-30 degrees	2	–	2	–	4
31-60 degrees	4	1	4	–	9
>60 degrees	3	2	3	–	8
Unifacially retouched flake					
Kind of Wear					
Smoothing	–	2	–	–	2
Feathered chipping	2	13	4	–	19
Feathered chipping/smoothing	–	2	5	–	7
Hinged chipping	2	14	6	–	22
Hinged chipping/smoothing	–	4	2	–	6
Location of Wear					
Edge only	–	2	–	–	2
Unifacial edge	4	28	13	–	45
Bifacial edge	–	4	3	–	7
Point only	–	1	–	–	1
Point any edge combo	–	–	1	–	1
Grouped Edge Angle					
1-30°	–	7	3	–	10
31-60 degrees	4	19	7	–	30
>60 degrees	–	9	6	–	15
Indeterminate	–	–	1	–	1
Utilized only					
Kind of Wear					
Abrasion/ginding	–	1	–	–	1
Smoothing	1	–	–	–	1
Feathered chipping	27	40	51	7	125
Feath chipping/smoothing	1	3	7	–	11
Hinged chipping	3	16	23	5	47
Hinged chipping/smoothing	1	2	5	2	10
Location of Wear					
Edge only	1	–	–	–	1
Unifacial edge	31	57	81	14	183
Bifacial edge	1	4	5	–	10
Point/unifacial edge	–	1	–	–	1
Grouped Edge Angle					
1-30 degrees	23	30	50	6	109
31-60 degrees	9	19	29	4	61
>60 degrees	1	13	7	4	25
Indeterminate					
Kind of Wear					
Feath chipping/crushing	–	1	–	–	1
Hinged chipping/smoothing	–	1	–	–	1
Location of Wear					
Bifacial edge	–	2	–	–	2
Grouped Edge Angle					
31-60 degrees	–	1	–	–	1
>60 degrees	–	1	–	–	1

	Master Number:	Tool:	Provenience/Level:	Zone:	Material:
a	177	Graver	0N40W/80	2	Jasper
b	277	Graver	4N22W/110	3	Jasper
c	106	Drill	2N41W/70	3	Jasper
d	18	Scraper	1S44W/80B	Testing	CCS
e	327	Scraper	2N49W/90	2	Chalcedony
f	365	Scraper	1N49W/50	2	Chalcedony
g	443	Scraper	2S33W/160	3	Jasper
h	654	Scraper	3N50W/130A	3	Jasper
i	441	Biface	2S33W/150	3	Jasper
j	160	Biface	5S12W/40	3	Jasper
k	502	Tip	2S38W/150	4	Jasper
l	54	Tip	9S16W/40	2	Jasper

Plate 3-1. Gravers, bifaces, drills, 45-DO-204.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c
d
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g
h
i
j
k
l

Master Number:
Tool:
Provenience/Level:
Zone:
Material:

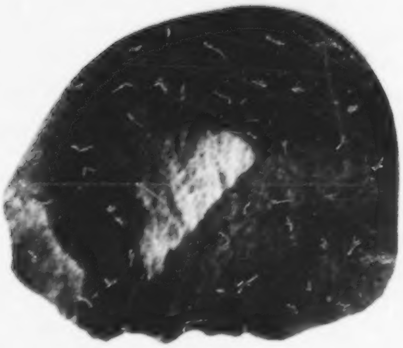
a	b
113	278
Chopper	Hammerstone
2N41W/90	4N21W/30
3	1
Basalt	Basalt

c	d
242	392
Chopper	Hammerstone
1S39W/130	4N15W/10
3	1
Basalt	Granite

e

340
Intermediate (pestle)
2N49W/140
3
Granite

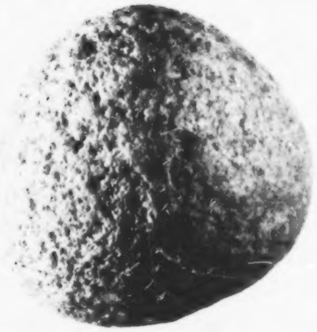
Plate 3-2. Cobble tool types, 45-DO-204.



a

b

c



d

e

and hard materials. Further, unifacially retouched and utilized only tools show these kinds of wear on points as well as edges, representing a continuum of tools uses that resembles that of more traditionally defined tool types. In the case of retouched flakes, it must be kept in mind that it is difficult to distinguish between reduction through manufacture and attrition through use. That some limited inferences about tool use are valid, however, is indicated by the presence of a similar range of wear types on both utilized only and retouched tools.

Distributions of functional object types and associated tool types document some variation in activities over time at the site. Generally, these are shifts in frequencies but there are some noteworthy functional indicators as well. For instance, the number of chopping tools increases markedly in Zone 3. A bimodal distribution of hammerstones occurs in Zones 1 and 3. Drills and gravers are present in Zones 2 and 3 but not in Zones 1 or 4. Scrapers are confined to Zones 2 and 3 as well. Wear on linear flakes occurs only in Zone 2. Finally, frequency of wear areas on unifacially retouched and utilized flakes increases significantly in Zones 2 and 3, although kinds and location of wear areas on utilized flakes are also well represented in Zone 1.

Table 3-15, Kind of Wear by Shape of Wear, and 3-16, Kind of Wear by Location of Wear, list functional tool types, irrespective of object type, in order to determine the distribution of tools by analytic zone. We did not list other dimensions because they are object-specific or were judged to offer little discrimination among use categories. For example, ORIENTATION OF WEAR, while of undeniable potential importance, invariably classified wear areas as perpendicular to the working surface. We have conflated the attributes that describe the shape of worn areas into four potential categories: convex, concave, straight, and point. Wear classified as "irregular" has been deleted. We have also conflated attributes describing locations of wear to form five potential categories: edge only, unifacial edge, bifacial edge, point only, and surface. Attributes describing kinds of wear remain identical to those presented in previous tables, and include all attributes coded on tools in this collection.

The distributions of tool types presented in Tables 3-15 and 3-16 confirm the patterns observed in functional object types (Table 3-13). Crushing-pecking tools are most frequent in Zone 3 (N=14, 66%). Hinged chipping and smoothing tools are prevalent in Zones 2 and 3 (hinged chipping, N=71, 84%; smoothing, N=21, 64%). Feathered chipping also occurs most frequently in Zones 2 and 3 (N=115, 75%). The only example of abrasion-grinding is found in Zone 1--an object coded as indeterminate which could have been called a pestle (Plate 3-2,e).

Table 3-16 reveals that wear on points is rare (N=12, 3%). Such wear is predominantly feathered chipping (N=6, 50%) and smoothing (N=2, 17%), although some specimens show hinged chipping-smoothing (N=4, 33%). The prevalence of feathered chipping and smoothing indicates the use of points on soft, pliable materials like hides. The hinged chipping-smoothing suggests their use on harder, elastic materials like bone, shell, or wood, and correlates with the occurrence of gravers in Zones 2 and 3. Feathered chipping and feathered chipping-smoothing on edges indicates light cutting or scraping functions, or

Table 3-15. Kind of wear by shape of wear, 45-DO-204.

Tool Type	Zone				Total[1]
	1	2	3	4	
Feathered chipping					
Convex	12	19	19	3	53
Concave	9	21	19	1	50
Straight	11	13	21	2	47
Point	–	3	–	–	3
Hinged chipping					
Convex	4	12	17	–	33
Concave	2	11	14	1	27
Straight	4	13	4	4	25
Smoothing					
Convex	11	6	7	–	24
Concave	–	1	–	–	1
Straight	1	4	1	–	6
Point	–	1	1	–	2
Crushing-pecking					
Convex	7	–	13	–	20
Straight	–	–	1	–	1
Feathered chipping-smoothing					
Convex	2	6	11	–	19
Concave	–	–	4	–	4
Straight	2	–	5	–	7
Point	1	1	1	–	3
Feathered chipping-crushing					
Convex	–	1	–	–	1
Hinged chipping-smoothing					
Convex	3	3	7	–	13
Concave	–	6	1	1	8
Straight	–	3	3	1	7
Point	–	1	3	–	4
Abrasion-grinding					
Convex	1	–	–	–	1
TOTAL	70	125	152	13	359

[1] Categories with no members have been excluded.

Table 3-16. Kind of wear by location of wear, 45-DO-204.

Tool Type	Zone				Total[1]
	1	2	3	4	
Feathered chipping					
Unifacial edge	31	49	58	7	145
Bifacial edge	2	5	4	-	11
Point only	-	2	-	-	2
Hinged chipping					
Unifacial edge	10	33	35	5	83
Bifacial edge	1	3	1	-	5
Smoothing					
Edge only	12	10	8	-	30
Bifacial edge	-	1	0	-	1
Point only	-	1	1	-	2
Crushing-pecking					
Unifacial edge	-	-	-	-	-
Bifacial edge	-	-	2	-	2
Surface	7	-	1	-	8
Feathered chipping-smoothing					
Unifacial edge	2	5	18	-	25
Bifacial edge	2	2	3	-	7
Point only	1	1	1	-	3
Feathered chipping-crushing					
Bifacial edge	-	1	-	-	1
Hinged chipping-smoothing					
Unifacial edge	3	7	7	2	19
Bifacial edge	-	5	4	-	9
Point only	-	1	3	-	4
Abrasion-grinding					
Unifacial edge	-	1	-	-	1
Bifacial edge	-	-	-	-	-
TOTAL	71	127	146	14	358

[1] Categories with no members have been excluded.

use on soft materials. The high frequencies of these tools suggest that butchering of meat and the working of hides were common activities; this correlates with the high counts of resharpened flakes, bifacially and unifacially retouched flakes, and utilized flakes. Hinged chipping and hinged chipping-smoothing on edges indicate heavier cutting and scraping functions on harder, though still elastic materials, probably related to butchering activities. These counts correlate with the presence of scrapers, bifacially retouched flakes, unifacially retouched flakes, and, to a lesser extent, utilized flakes. Many of these tools exhibit retouching (N=41, 53%): this suggests that an appropriate tool form was sought--in this instance, maintenance of a durable unifacial edge. Table 3-16 documents a high correlation of hinged chipping and hinged chipping-smoothing with unifacial edges (N=102, 85%). Except in combination with feathered and hinged chipping, smoothing wear on edges indicates scraping or possibly cutting, of soft, pliable materials like hides and meat. Functional object types with this kind of wear are predominantly projectile points, tabular knives, bifaces, and resharpened flakes--tool forms most probably associated with hunting and butchering. Such smoothing wear would likely result from skinning and fleshing of hides rather than the cutting of meat or bone. Smoothing wear is generally confined to edges only (N=30, 91%). Crushing wear does occur on edges, but is usually confined to convex surfaces (N=8, 80%). Such wear could indicate the processing of a variety of hard materials, but given the association of these tools with forms indicative of butchering, it seems likely that they were used to crack or crush bone. Hammerstones could also have been used in lithic reduction.

Differences in tool design and use are brought out in Figures 3-1 and 3-2 and Tables 3-17 through 3-20. Figures 3-1 and 3-2 are histograms describing edge angle distributions by wear-manufacture and wear only attributes (UTILIZATION-MODIFICATION) and these attributes by analytic zone. Tables 3-Q and 3-T list frequencies by five-degree intervals for KIND OF WEAR and SHAPE OF WEAR and show the distribution of these attributes by analytic zone. Tables 3-19 and 3-20 list frequencies for KIND OF WEAR by LOCATION OF WEAR and distributions by analytic zone. All attributes for dimensions other than UTILIZATION-MODIFICATION are listed, if they were applied to tools in this collection.

Edge angle by wear-manufacture produces a bimodal distribution, with higher frequencies in the range 6-40° and 41-75° (Figure 3-1). Edge angle by wear only shows a more skewed distribution, with a high peak in the range 6-35°; however, a slight increase in the range 51-65° does preserve the bimodal distribution seen for wear-manufacture. When the distributions are surveyed by analytic zone (Figure 3-2), these patterns change, marking differences in the manufacture and use of tool types. The bimodal distribution for wear-manufacture disappears, replaced by more regular distributions centered in the range 35-80°. Zone 3, in particular, shows a dramatic increase in the range 56-80°. Distributions for wear only are more markedly skewed, with consistent peaks in the range 16-30°, irrespective of analytic zone.

Table 3-17. Kind of wear by shape of wear by object edge angle.

Kind of Wear	Shape of Worn Area	Object Edge Angle																						Total
		1 5	6 10	11 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 80	81 85	86 90	91 95	> 95	S[1]	NA	
Abrasion/grinding	Convex	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	1
Smoothing	Convex	–	–	–	–	–	4	1	2	4	5	1	1	4	–	1	–	–	–	1	–	–	–	24
	Concave	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
	Straight	–	–	–	–	–	–	–	–	1	2	1	–	1	–	–	–	–	–	–	1	–	–	6
	Point	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	2
Crushing/pecking	Convex	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	19	–	20
	Straight	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	1
Feathered chipping	Convex	–	3	10	9	10	5	2	1	1	2	3	2	1	1	3	–	–	–	–	–	–	–	53
	Concave	–	3	1	10	7	6	3	7	2	–	3	3	3	1	1	–	–	–	–	–	–	–	50
	Straight	1	4	5	8	10	4	3	1	3	–	1	5	–	1	–	–	1	–	–	–	–	–	47
	Point	–	–	–	1	–	–	1	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	3
	Irregular	–	–	1	1	1	–	1	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	5
Feathered chipping/smoothing	Convex	–	–	–	–	2	1	1	2	3	3	–	3	–	2	1	–	–	–	–	1	–	–	19
	Concave	–	–	–	2	1	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	4
	Straight	–	–	–	1	–	–	–	–	–	–	2	1	1	–	2	–	–	–	–	–	–	–	7
	Point	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–	–	–	–	–	–	1	3
	Irregular	–	–	–	–	1	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	2
Feathered chipping/crushing	Convex	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1
Hinged chipping	Convex	–	–	–	1	1	3	3	1	3	2	2	4	6	4	2	1	–	–	–	–	–	–	33
	Concave	–	–	–	3	2	–	–	1	2	2	4	5	2	2	–	1	1	–	–	3	–	–	29
	Straight	–	–	1	1	2	2	1	–	3	2	1	1	3	2	2	3	–	–	–	1	–	–	25
	Irregular	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–	–	–	2
Hinged chipping/smoothing	Convex	–	1	–	1	1	1	–	1	–	–	2	1	1	1	–	–	2	–	–	1	–	–	13
	Concave	–	–	–	1	1	–	1	–	–	–	–	2	–	–	–	2	–	1	–	–	–	–	8
	Straight	–	–	–	–	–	–	1	–	–	1	2	1	1	1	–	–	–	–	–	–	–	–	7
	Point	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–	–	–	–	2	4

[1] Surface

Table 3-18. Kind of wear by shape of wear by object edge angle by zone, 45-DO-204.

Kind of Wear	Shape of Worn Area	Zone	Object Edge Angle																						Total
			1 5	6 10	11 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 80	81 85	86 90	91 95	> 95	S¹	NA	
Abrasion/grinding	Convex	2	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
Smoothing	Convex	1	-	-	-	-	-	3	1	1	2	3	-	-	1	-	-	-	-	-	-	-	-	-	11
		2	-	-	-	-	-	1	-	1	1	-	-	-	1	-	1	-	-	-	1	-	-	-	6
		3	-	-	-	-	-	-	-	-	1	2	1	1	2	-	-	-	-	-	-	-	-	-	7
	Concave	2	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Straight	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
		2	-	-	-	-	-	-	-	-	1	2	-	-	1	-	-	-	-	-	-	-	-	-	4
		3	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
	Point	2	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
		3	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
Crushing/packing	Convex	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	-	7
		3	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	12	-	13
	Straight	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1
Feathered chipping	Convex	1	-	1	2	1	3	1	1	-	1	-	1	-	-	-	1	-	-	-	-	-		-	12
		2	-	1	2	4	5	1	-	-	-	2	1	1	-	-	2	-	-	-	-	-	-	-	19
		3	-	1	6	2	2	3	1	1	-	-	1	-	1	1	-	-	-	-	-	-	-	-	19
		4	-	-	-	2	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	3
	Concave	1	-	-	1	4	1	-	-	1	-	-	-	2	-	-	-	-	-	-	-	-	-	-	9
		2	-	2	-	4	2	2	-	3	2	-	1	1	3	1	-	-	-	-	-	-	-	-	21
		3	-	1	-	2	4	4	2	3	-	-	2	-	-	-	1	-	-	-	-	-	-	-	19
		4	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Straight	1	-	1	1	3	3	-	1	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	11
		2	-	1	1	1	3	2	1	-	1	-	-	2	-	1	-	-	-	-	-	-	-	-	13
		3	1	2	3	3	4	2	1	1	1	-	1	2	-	-	-	-	-	-	-	-	-	-	21
		4	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	2
	Point	2	-	-	-	1	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	3
	Irregular	1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
		3	-	-	1	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	3
		4	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1

Table 3-18. Cont'd.

Kind of Wear	Shape of Worn Area	Zone	Object Edge Angle																						Total
			1 5	6 10	11 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 80	81 85	86 90	91 95	> 95	S^1	NA	
Feathered chipping/smoothing	Convex	1	-	-	-	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	2
		2	-	-	-	-	1	-	-	1	1	1	-	1	-	-	1	-	-	-	-	-	-	-	6
		3	-	-	-	-	-	1	1	1	2	1	-	2	-	2	-	-	-	-	-	1	-	-	11
	Concave	3	-	-	-	2	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	4
	Straight	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	2
		3	-	-	-	1	-	-	-	-	-	-	1	1	1	-	1	-	-	-	-	-	-	-	5
	Point	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
		2	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1
		3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
	Irregular	2	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
		3	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1
Feathered chipping/crushing	Convex	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1
Hinged chipping	Convex	1	-	-	-	-	-	1	1	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	4
		2	-	-	-	-	1	-	1	-	2	1	1	-	2	4	-	-	-	-	-	-	-	-	12
		3	-	-	-	1	-	2	1	1	1	1	-	3	4	-	2	1	-	-	-	-	-	-	17
	Concave	1	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2
		2	-	-	-	1	1	-	-	-	1	1	1	1	2	-	-	1	-	-	-	2	-	-	11
		3	-	-	-	2	1	-	-	-	-	1	3	4	-	2	-	-	-	-	-	1	-	-	14
		M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1
Hinged chipping	Straight	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	2	-	-	-	-	-	-	4
		2	-	-	-	1	1	-	1	-	3	1	-	-	1	2	1	1	-	-	-	1	-	-	13
		3	-	-	-	-	-	2	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	4
		M	-	-	1	-	1	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	4
	Irregular	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
		3	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1

Table 3-18. Cont'd.

Kind of Wear	Shape of Worn Area	Zone	Object Edge Angle																						Total
			1 5	6 10	11 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 80	81 85	86 90	91 95	> 95	S[1]	NA	
Hinged chipping/smoothing	Convex	1	-	-	-	-	1	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	3
		2	-	-	-	-	-	-	-	1	-	-	1	-	-	1	-	-	-	-	-	-	-	-	3
		3	-	1	-	1	-	1	-	-	-	-	-	-	1	-	-	-	2	-	-	1	-	-	7
	Concave	2	-	-	-	1	-	-	1	-	-	-	-	1	-	-	-	2	-	1	-	-	-	-	6
		3	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
		4	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1
	Straight	2	-	-	-	-	-	-	1	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	3
		3	-	-	-	-	-	-	-	-	-	1	-	1	-	1	-	-	-	-	-	-	-	-	3
		4	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
	Point	2	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1
		3	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	2	3

[1] Surfaca

Table 3-19. Kind of wear by length of wear by object edge angle, 45-DO-204.

Kind of Wear	Location of Wear	Object Edge Angle																						Total
		1 5	6 10	11 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 80	81 85	86 90	91 95	> 95	S[1]	NA	
Abrasion/grinding	Unifacial edge	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
Smoothing	Edge only	-	-	-	-	-	4	1	3	5	7	2	1	5	-	1	-	-	-	-	1	-	-	30
	Bifacial edge	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1
	Point only	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
	Point and two edges	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
Crushing/ pecking	Bifacial edge	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	2
	Surface	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
	Terminal surface	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	-	18
Feathered chipping	Unifacial edge	1	10	16	25	26	15	10	6	6	2	7	10	4	3	3	-	1	-	-	-	-	-	145
	Bifacial edge	-	-	1	3	2	-	-	3	-	-	-	1	-	-	1	-	-	-	-	-	-	-	11
	Point only	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Point unifacial	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
Feathered chipping/smoothing	Unifacial edge	-	-	-	3	3	-	1	2	3	2	2	3	1	2	2	-	-	-	-	1	-	-	25
	Bifacial edge	-	-	-	-	1	1	-	-	1	1	-	1	-	1	1	-	-	-	-	-	-	-	7
	Point and two edges	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	1	3
Feathered chipping/crushing	Bifacial edge	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1
Hinged chipping	Unifacial edge	-	-	1	3	5	5	4	2	8	7	7	10	9	8	4	5	1	-	-	4	-	-	83
	Bifacial edge	-	-	-	2	-	-	-	-	-	-	-	1	2	-	-	-	-	-	-	-	-	-	5
Hinged chipping/smoothing	Unifacial edge	-	1	-	1	2	1	1	1	-	-	2	3	1	1	-	1	2	1	-	1	-	-	19
	Bifacial edge	-	-	-	1	-	-	1	-	-	1	2	1	1	1	-	1	-	-	-	-	-	-	9
	Point and two edges	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	2	4

---

[1] Surface

Table 3-20. Kind of wear by length of wear by object edge angle by zone, 45-DO-204.

Kind of Wear	Location of Wear	Zone	Object Edge Angle																						Total
			1 5	6 10	11 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 80	81 85	86 90	91 95	> 95	S1	NA	
Abrasion/grinding	Unifacial edge	2	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
Smoothing	Edge only	1	-	-	-	-	-	3	1	1	2	3	-	-	1	-	-	-	-	-	-	1	-	-	12
		2	-	-	-	-	-	1	-	2	2	2	-	-	2	-	1	-	-	-	-	-	-	-	10
		3	-	-	-	-	-	-	-	-	1	2	2	1	2	-	-	-	-	-	-	-	-	-	8
	Bifacial edge	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1
	Point only	3	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
	Point and two edges	2	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
Crushing/packing	Bifacial edge	3	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	2
	Surface	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
	Terminal surface	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	-	7
Feathered chipping	Unifacial edge	1	-	2	4	8	6	1	3	1	2	-	1	3	-	-	-	-	-	-	-	-	-	-	31
		2	-	4	3	6	9	5	2	2	3	2	2	4	3	2	2	-	-	-	-	-	-	-	49
		3	1	4	9	8	10	9	4	3	1	-	4	2	1	1	1	-	-	-	-	-	-	-	58
		4	-	-	-	3	1	-	1	-	-	-	-	1	-	-	-	-	1	-	-	-	-	-	7
	Bifacial edge	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	2
		2	-	-	-	3	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
		3	-	-	1	-	-	-	-	2	-	-	-	1	-	-	-	-	-	-	-	-	-	-	4
	Point only	2	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	Point unifacial	2	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
Feathered chipping/smoothing	Unifacial edge	1	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	2
		2	-	-	-	-	2	-	-	1	-	-	-	1	-	-	1	-	-	-	-	-	-	-	5
		3	-	-	-	3	1	-	1	1	3	1	1	2	1	2	1	-	-	-	-	1	-	-	18
	Bifacial edge	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	2
		2	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	2
		3	-	-	-	-	-	1	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	3
	Point and two edges	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
		2	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1
		3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
Feathered chipping/crushing	Bifacial edge	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1
Hinged chipping	Unifacial edge	1	-	-	-	-	-	1	1	1	1	2	1	-	-	-	1	2	-	-	-	-	-	-	10
		2	-	-	-	-	3	-	2	-	6	3	2	1	4	6	1	2	-	-	-	3	-	-	33
		3	-	-	-	3	1	4	1	1	1	2	4	8	3	2	2	1	-	-	-	1	-	-	35
		4	-	-	1	-	1	-	-	-	-	-	-	-	2	-	-	-	1	-	-	-	-	-	5
	Bifacial edge	11	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1
		12	-	-	-	2	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	3
		13	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1

Table 3-20. Cont'd.

Kind of Wear	Location of Wear	Zone	Object Edge Angle																					Total
			1 5	6 10	11 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 80	81 85	86 90	91 95	> 95	S[1]	NA	
Hinged chipping/smoothing	Unifacial edge	1					1						1	1											3
		2							1	1				1	1	1		1		1					7
		3		1		1	1	1											2			1			7
		4											1	1											2
	Bifacial edge	2				1			1				2					1							5
		3										1		1	1	1									4
	Point and two edges	2														1									1
		3													1									2	3

[1] Surface

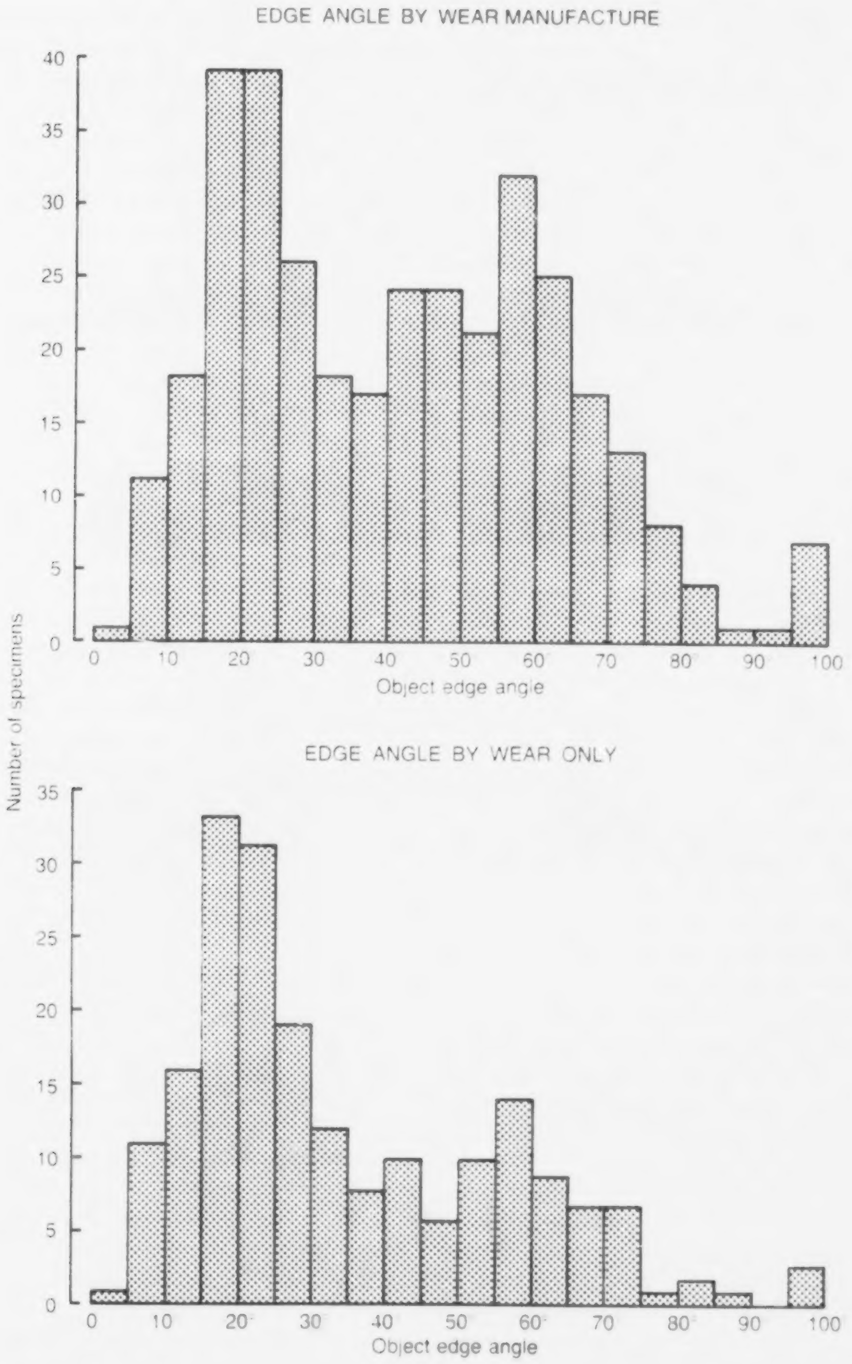


Figure 3-1. Edge angle by wear-manufacture and wear only, 45-DO-204.

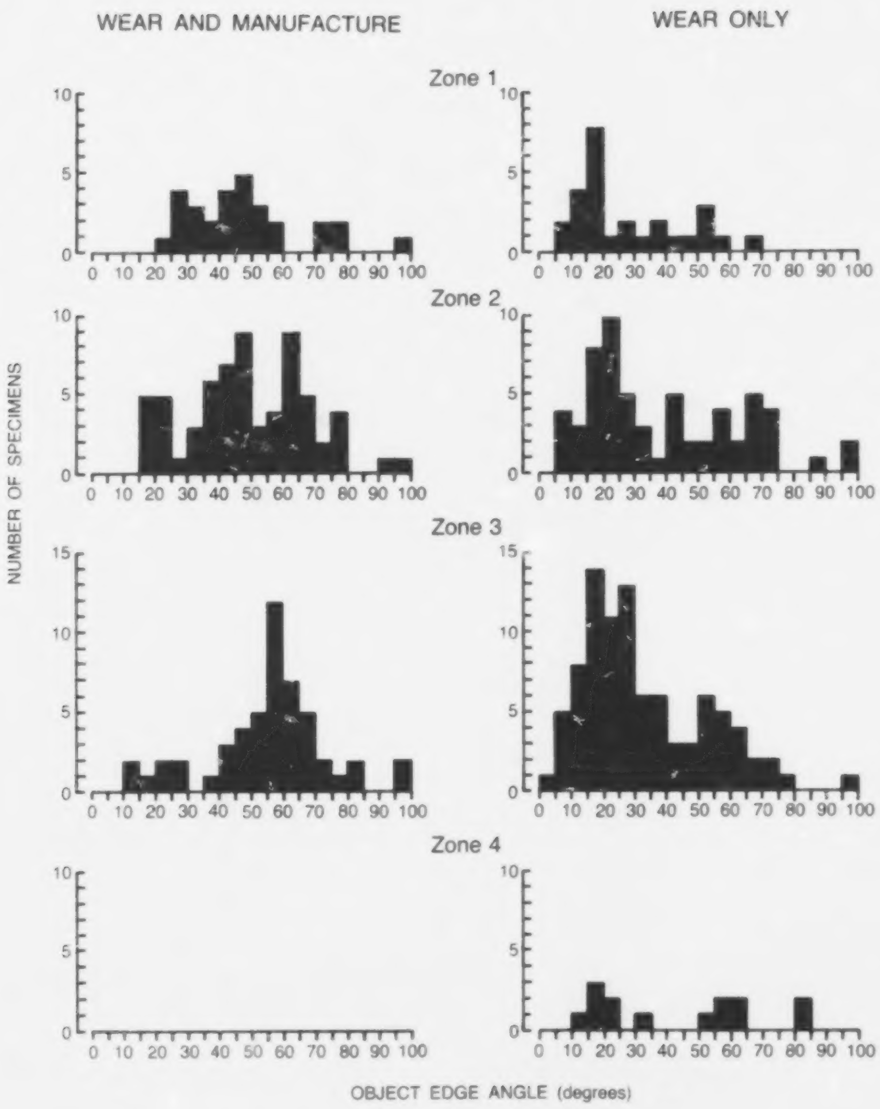


Figure 3-2. Edge angle distribution by wear-manufacture and wear only by zone, 45-DO-204.

Tables 3-17 through 3-20, which show edge angle distributions ordered by the other wear dimensions, reinforce these patterns and support postulated differences in tool use and form. Smoothing wear on edges and points of various shapes consistently fall within the range 26-75°. Crushing on edges is restricted to a more oblique range between 61-80°. Feathered chipping on unifacial and bifacial edges of whatever shape produces skewed, yet bimodal distributions, with high frequencies in the range 6-35° and a lower peak in the range 51-60°. Hinged chipping on unifacial and bifacial edges of any shape has a more regular distribution, spanning a broad range from 11-85°, with higher frequencies in the more oblique range from 41-70°. Smoothing and crushing associated with feathered and hinged chipping wear fall within the ranges noted for smoothing and crushing above. Edge angle distributions by analytic zone (Tables 3-17 and 3-20) show these same patterns over the span of human occupation at the site. High frequencies shift somewhat across edge angle intervals, but these changes are not marked. Given this fact, the small sample size, and the breadth of the edge angle intervals within each functional type, we must be cautious in making inferences. However, it does seem likely that tool types and tool use changed little over the time represented at this site.

Distributions of edge angles by tool type bear out distinctions made earlier between various tool forms, and support inferences about uses of certain tools. Feathered chipping wear on edges consistently shows a distribution skewed toward a more acute edge angle range, in keeping with the assumption that the light cutting of soft material produced this wear. Hinged chipping on edges has a distribution concentrated in a more oblique edge angle range, supporting the inference that this wear was produced by the heavy cutting and scraping of hard materials that required a durable cutting edge. Although infrequent, crushing on edges falls within even more oblique edge angle ranges, commensurate with heavy, durable tools used to process hard materials. Smoothing wear by itself, or in combination with these categories, consistently falls within an oblique range similar to that of hinged chipping wear, suggestive of tool uses requiring a working edge able to withstand the application of considerable pressure such as that of a scraper or a flesher.

Surveying the findings of the functional analysis, we have noted several distinct patterns in the tool assemblage. Most implements can be classified as cutting or scraping tools (knives, retouched and utilized flakes, scrapers). Wear usually consists of feathered chipping and smoothing, indicating light cutting and scraping of soft, pliable materials. Hinged chipping and smoothing is less prevalent but still common, and indicates similar working of harder materials, or more intensive activity. Wear usually occurs on edges perpendicular to the cutting edge. Some tool objects, such as drills and gravers, have feathered and hinged chipping wear on points, indicating the piercing or cutting of soft to hard elastic materials. A few tool objects (choppers, hammerstones, and pestles) exhibit crushing and pecking wear on surfaces, indicating their use on hard materials, perhaps related to butchering or the reduction of stone. Resharpened and retouched flakes occur frequently and indicate that tools were reused during single, intensive periods of activity or over prolonged stays involving a variety of activities.

While the distribution of the formal object types varies somewhat among analytic zones, that of wear-defined tool types suggests a uniformity in tool use and human activity over time. Small numbers of distinctive object types indicate a higher intensity of activity in Zones 2 and 3. Study of tool types gives us a more refined picture of tool distribution and use characteristics. Feathered chipping and hinged chipping wear are prevalent in all zones. Smoothing, in combination with or separate from these wear types, is also distributed uniformly over time. Crushing-pecking and abrasion-grinding, however, show higher frequencies in Zone 1 and Zone 3, indicating more frequent reduction of harder materials and non-animal by-products during these periods of human occupation. Wear characteristics reveal that implements in Zone 2 and 3 tended to receive more prolonged use.

Butchering and the processing of animal products such as hide and bone must have been frequent activities at the site. Utilized flakes, resharpened and retouched flakes, the most common tool objects, show wear indicative of dressing and butchering. The more specialized tool objects--scrapers, drills, and gravers--are less numerous and reveal that the processing of hunting by-products other than meat was a less central activity. Clearly, however, the site occupants utilized much of the carcass. They cut meat from the bone with flakes, bifaces, and other more generalized knife forms. They cleaned and worked hides with scrapers, fleshers, and drills. (Some of these fleshers are tabular quartzite flakes, as indicated by the smoothing wear on their steep unifacial edges.) They used choppers, heavy, durable flakes, and gravers to reduce bones to get at the marrow, or to manufacture tools. They may have also used hammerstones as part of the butchering/manufacturing process; or they may have used them to produce butchering tools from stone.

In summary, site 45-DO-204 appears to have been a frequently visited hunting and processing camp, where game was prepared for eating and bone and hides were worked. Except for the single pestle recovered from Zone 1, there is little evidence of plant gathering and processing. Other tools may have been used to process vegetable foods or by-products; however, the preponderance of cutting and scraping tools suggests that such processing played a minor role in the activities at the site. Over time, patterns of tool use are very consistent, with variation in tool type and wear distributions attributable to shifts in intensity of activity rather that changes in economy.

STYLISTIC ANALYSIS

Two separate but conceptually related analyses are used to classify projectile points. A morphological classification is used to define descriptive types that do not directly correspond to recognized historical types. This is intended as an independent check on the temporal distribution of projectile point forms in the Rufus Woods Lake project area and as a means to measure the distribution of formal attributes as well as point styles. An historical classification correlates these projectile points with recognized types with discrete temporal distributions. A multivariate statistical program which compares line and angle measurements taken along the outlines of the points is used to classify the specimens. Together, these analyses allow us to (1) assess formal and temporal variation in our collection without first imposing prior typological constructs, (2) correlate specimens recovered from our study area with those found elsewhere on the Columbia Plateau in a consistent, verifiable manner, (3) develop a typology that incorporates both qualitative and quantitative scales of measurement, and (4) examine the temporal significance of specific formal attributes as well as aggregates viewed as ideal types.

Eleven classificatory dimensions have been defined for morphological classification: BLADE/STEM JUNCTURE, OUTLINE, STEM EDGE ORIENTATION, SIZE, BASAL EDGE SHAPE, BLADE EDGE SHAPE, CROSS SECTION, SERRATION, EDGE GRINDING, BASAL EDGE THINNING, and FLAKE SCAR PATTERN. Of these, the first four (DI-DIV) define 18 morphological types. The other seven serve to describe these types more fully, and permit the identification of variants within the types. Table 3-21 outlines these dimensions and associated attributes.

By defining the margins of projectile points, we are able to place them within one of the 18 morphological types. This is done by drawing straight lines from nodes where the outline of the specimen changes direction. Figure 3-3 illustrates the technique. For a corner-notched triangular point, the blade is defined as line segment $\overline{\text{a-A}}$. The shoulder is line segment $\overline{\text{A-1}}$. The neck is node 1. The stem is line segment $\overline{\text{1-2}}$. The base is line segment $\overline{\text{2-a'}}$. Terms applied and the number of line segments drawn vary given the two basic subdivisions of form. Lanceolates are generally defined by four or less line segments (aA12). Stemmed triangular forms are defined by five or less line segments (aA123). Side-notched triangular forms are defined by five or more line segments (aA12345). Table 3-22 lists the 18 morphological types with descriptions, classification codes, and line segment definitions.

Cross-tabulation of classificatory dimensions DV-DXI supplies detailed descriptions of the 18 morphological types and allows us to assess the temporal distribution of formal attributes as well as that of point styles. We might subdivide any or all of the types in terms of their basal edge shape, serration, or flaking pattern. We can also assess the chronological significance of concave bases, serrated margins, or regular collateral flaking pattern independent of associated morphological type. Further, we can use this information to establish variants in the basic historical types.

We have defined historical types on the basis of line and angle measurements in order to have a consistent classification method which utilizes published illustrations of projectile points. Other measurements such as weight and thickness were taken on projectile points in our collection, but cost and efficiency requirements precluded handling of specimens from other study areas. These measurements can be included in analyses of our points, and, hence, for definition of types and type variants that will correlate with acknowledged types, but they are not part of the initial typological exercise. Justification for this decision is found in prior research emphasizing the outline of projectile points as the basis of classification (Ahler 1970; Benfer 1967; Gunn and Prewitt 1975; Holmer 1978).

Table 3-21. Dimensions of morphological projectile point classification.

DIMENSION I: BLADE-STEM JUNCTURE

N. Not separate
1. Side-notched
2. Shouldered
3. Squared
4. Barbed
9. Indeterminate

DIMENSION II: OUTLINE

N. Not applicable
1. Triangular
2. Lanceolate
9. Indeterminate

DIMENSION III: STEM EDGE ORIENTATION

N. Not applicable
1. Straight
2. Contracting
3. Expanding
9. Indeterminate

DIMENSION IV: SIZE

N. Not applicable
1. Large
2. Small

DIMENSION V: BASAL EDGE SHAPE

N. Not applicable
1. Straight
2. Convex
3. Concave
4. Point
5. 1 or 2 and notched
9. Indeterminate

DIMENSION VI: BLADE EDGE SHAPE

N. Not applicable
1. Straight
2. Excurvate
3. Incurvate
4. Reworked
9. Indeterminate

DIMENSION VII: CROSS SECTION

N. Not applicable
1. Planoconvex
2. Biconvex
3. Diamond
4. Trapezoidal
9. Indeterminate

DIMENSION VIII: SERRATION

N. Not applicable
1. Not serrated
2. Serrated
9. Indeterminate

DIMENSION IX: EDGE GRINDING

N. Not applicable
1. Not ground
2. Blade edge
3. Stem edge
9. Indeterminate

DIMENSION X: BASAL EDGE THINNING

N. Not applicable
1. Not thinned
2. Short flake scars
3. Long flake scars
9. Indeterminate

DIMENSION XI: FLAKE SCAR PATTERN

N. Not applicable
1. Variable
2. Uniform
3. Mixed
4. Collateral
5. Transverse
6. Other
9. Indeterminate

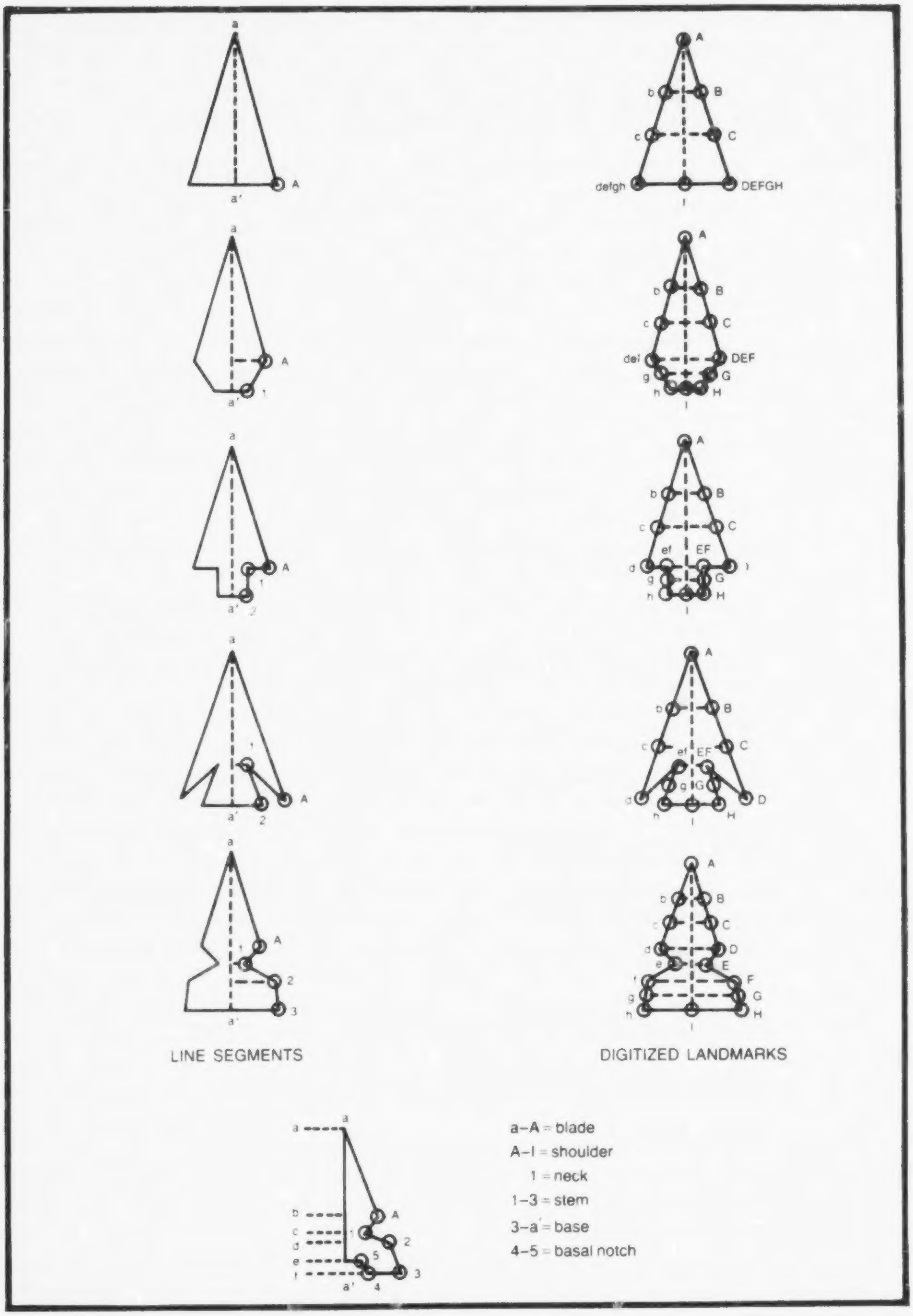

LINE SEGMENTS
DIGITIZED LANDMARKS
a–A = blade
A–1 = shoulder
1 = neck
1–3 = stem
3–a′ = base
4–5 = basal notch
a
a′
A
defgh
DEFGH
dei
DEF
ef
EF

Figure 3-3. Definition of projectile point outline.

Table 3-22. Morphological classes of projectile points: descriptive name, classification code, and line segment definition.

Type	Description	Classification	Definition
1	Large Triangular	N 1 N 1	$\overline{a\ A}$
2	Small Triangular	N 1 N 2	$\overline{a\ A}$
3	Large Side-notched	1 N N 1	$\overline{aA123}$, $\overline{aA1234}$, $\overline{aA12345}$
4	Small Side-notched	1 N N 2	$\overline{aA123}$, $\overline{aA1234}$, $\overline{aA12345}$
5	Lanceolate	N 2 N N	$\overline{a\ A}$
6	Shouldered Lanceolate	2 2 N N	$\overline{a\ A}$, $\overline{aA1}$, $\overline{aA12}$
7	Large, Shouldered Triangular, contracting stem	2 1 2 1	$\overline{a\ A}$, $\overline{aA1}$
8	Small, Shouldered Triangular, contracting stem	2 1 2 2	$\overline{a\ A}$, $\overline{aA1}$
9	Large, Shouldered Triangular, non-contracting stem	2 1 (13) 1	$\overline{aA12}$, $\overline{aA123}$
10	Small, Shouldered Triangular, non-contracting stem	2 1 (13) 2	$\overline{aA12}$, $\overline{aA123}$
11	Large, Squared Triangular, contracting stem	3 1 2 1	$\overline{aA1}$
12	Small, Squared Triangular, contracting stem	3 1 2 2	$\overline{aA1}$
13	Large, Squared Triangular, non-contracting stem	3 1 (13) 2	$\overline{aA12}$, $\overline{aA123}$
14	Small, Squared Triangular, non-contracting stem	3 1 (13) 1	$\overline{aA12}$,$\overline{aA123}$
15	Large, Barbed Triangular, contracting stem	4 1 2 1	$\overline{aA1}$
16	Small, Barbed Triangular, contracting stem	4 1 2 2	$\overline{aA1}$
17	Large, Barbed Triangular, non-contracting stem	4 1 (13) 1	$\overline{aA12}$, $\overline{aA123}$
18	Small, Barbed Triangular, non-contracting stem	4 1 (13) 2	$\overline{aA12}$, $\overline{aA123}$

Our desire for a statistically derived classification prompted selection of a multivariate statistical method termed discriminant analysis (Nie et al. 1975). In this analysis, individual specimens are sorted into selected groups on the basis of mathematical equations derived from analysis of cases with known memberships. First, we assembled representative specimens for each acknowledged historical type, and tested group autonomy through analysis of specified discriminating variables. Then, we used derived equations called discriminant functions to assign specimens in our collection to the statistically defined projectile point types. All cases are given a probability of group membership, calculated as the difference between a given case score and a group score. Discriminating variables--those providing the most separation between groups--are ranked and serve as type definitions. The outcome is a statistically defensible projectile point typology based on traditional, intuitively derived classifications. The resulting classification is consistent, and produces mathematically defined ranges of variability. It enables the researcher to quickly categorize a large collection, and it offers a sound, rational basis for definition of new types as well as an explicit definition of accepted types. We can thereby correlate the Rufus Woods Lake projectile point sequence with other chronologies in both a quantitative and qualitative manner. For a detailed discussion of procedures and assumptions involved in discriminant analysis see Johnson (1978) and Klecka (1980).

We assembled a type collection for the Columbia Plateau of over 1,200 specimens that constituted originally defined type examples, labelled specimens of recognized types, or type variants that were reasonably well-dated. Reviewing the archaeological literature, we identified 23 historical types which we arranged in six formal type series (Figure 3-4). We consistently applied distinctions based on the original type definitions, modified, where appropriate, by subsequent research. We routinely defined type variants, usually suggested by prior researchers, which segregate specimens according to diagnostic patterns in morphology. Historical types identified here represent a synthesis of projectile point types and cultural reconstructions postulated by researchers in different areas of the Columbia Plateau, and were not taken from any single typology or chronological sequence (e.g., Butler 1961, 1962; Leonhardy and Rice 1970; Nelson 1969). Names are usually those applied by the first researcher to define a specific type. We developed variant labels by using the accepted type name followed by a letter denoting diagnostic variation. For a complete discussion of procedures followed see Lohse (1983g).

Six projectile points could be assigned to defined historical types; five fragments could not (Table 3-23). Applicable morphological attributes were coded for all specimens; only one fragment could not be assigned to a morphological type. The five historical types represented document all three cultural phases defined for the Rufus Woods Lake project area: Kartar Phase (ca. 7000-4000 B.P.), Hudnut Phase (ca. 4000-2000 B.P.), and Coyote Creek Phase (ca. 2000-200 B.P.). One Cascade C specimen and a Mahkin Shouldered specimen were found in Zone 3, which has been radiocarbon dated at 4395±106 B.P. and 4590±143 B.P. One Rabbit Island Stemmed B was recovered from a

HISTORICAL TYPE CLASSIFICATION

DIVISION	LANCEOLATE		TRIANGULAR			
SERIES	SIMPLE	SHOULDERED	SIDE-NOTCHED	CORNER-REMOVED	CORNER-NOTCHED	BASAL-NOTCHED
TYPE	11 LARGE LANCEOLATE	12 LIND COULEE	41 COLD SPRINGS	51 NESPELEM BAR	61 COLUMBIA A Corner-notched	71 QUILOMENE A Basal-notched
	15 WINDUST C Contracting base	13 WINDUST A	42 PLATEAU Side-notched	52 RABBIT ISLAND A	62 QUILOMENE Corner-notched	72 QUILOMENE B Basal-notched
	21 CASCADE A	14 WINDUST B		53 RABBIT ISLAND B	63 COLUMBIA B Corner-notched	73 COLUMBIA STEM A
	22 CASCADE B	31 MAHKIN SHOULDERED			64 WALLULA Rectangular stemmed	74 COLUMBIA STEM B
	23 CASCADE C					75 COLUMBIA STEM C

Types are numbered consecutively within formal series a two-digit code indicates the approximate temporal sequence of defined series and types

Type names are those most commonly applied Mahkin Shouldered and Nespelem Bar are types defined for the Rufus Woods Lake project area

Figure 3-4. Historical projectile point type classification.

charcoal-stained living surface in Zone 2, radiocarbon dated at 2812±344 B.P. Another Rabbit Island Stemmed B was collected from the beach in front of the site. The single Rabbit Island Stemmed A was found in Zone 1, which has radiocarbon dates of 592±71 B.P. and 655±67 B.P.

Table 3-23. Classified projectile points and fragments, 45-DO-204.

Type	Classification	Zone	Feature	Association
Cascade A	N2NN2221121	1	—	—
Cascade C	N2NN2211131	3	—	—
Mahkin Shouldered	22NN9211121	3	—	—
Rabbit Island A	31212132NN1	1	—	—
Rabbit Island B	31224122NN3	Beach	—	—
Rabbit Island B	31224222NN1	2	2	Charcoal-stained living surface
NI[1]	N1N2N141NN3	4	—	—
NI	N2NN1241111	3	—	—
NI	N2NN2241124	2	—	—
NI	21N29141NN3	2	—	—
NI	9929292912 9	1	—	—

[1] Historical type not identifiable.

We describe these specimens below; included are physical characteristics, notes of historical and functional interest, existence of comparable specimens, and established type references. While our listings of authors and comparable specimens are not comprehensive, they should alert the reader to similar artifacts recovered in nearby study areas. Three measurements are presented for each point: length, taken along a perpendicular axis bisecting the blade and haft; width, taken along a horizontal axis passing across the broadest part of the blade or blade/haft juncture; and thickness, taken through the blade/haft juncture.

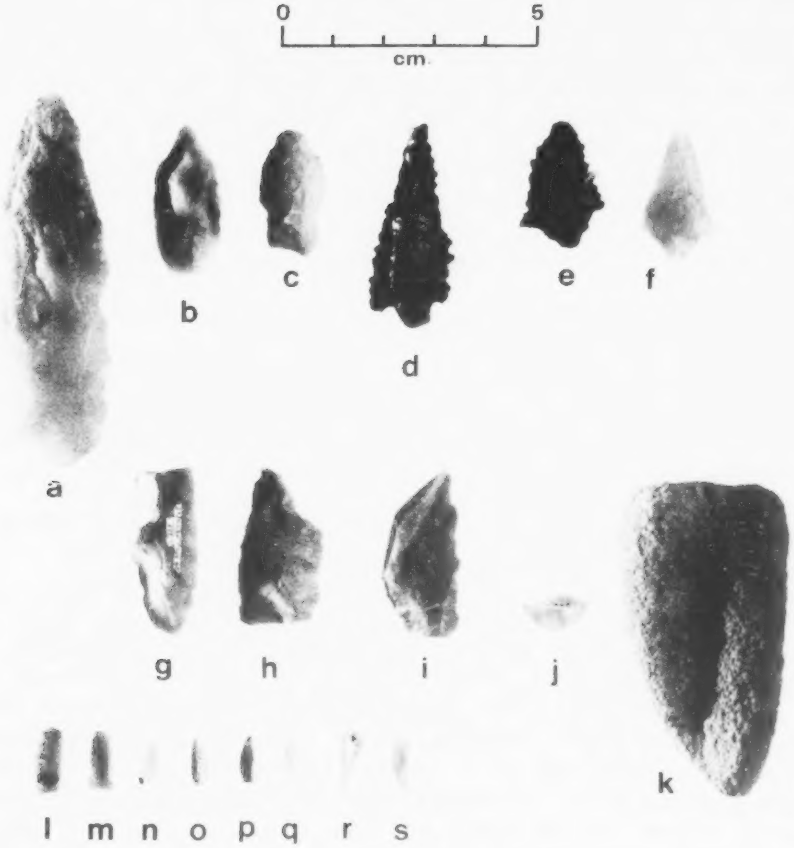
CASCADE A. (Plate 3-C;a)

Number of Specimens: 1

Provenience:	Material:	Measurement:
Zone 1	Quartzite	7.3/2.3/.6 cm

	Master Number:	Tool/type	Provenience/Level:	Zone:	Material:
a	1	Cascade A	3N30W/20B	1	Quartzite
b	291	Cascade C	4N2W/100 **21W7**	3	Jasper
c	593	Mahkin shouldered	8S46W/100	2	Jasoer
d	262	Rabbit Island A	8S38W/20	1	Jasoer
e	16	Rabbit Island C	3N50W/FE2/70B	Testing	CCS
f	40	Rabbit Island C	Beach	—	CCS
g	321	Biface	2N49W/40	1	Jasper
h	442	Base	2S33W/150	3	Jasper
i	91	Biface	2N42E/110	3	Fine-grained quartzite
j	342	Biface	1N50W/10	1	Jasper
k	243	Shaft Abrader	1S39W/130	3	Sandstone
l	652	Linear Flake	1N42W/130	3	Jasper
m	179	Linear Flake	0N40W/100	2	Jasper
n	230	Linear Flake	1S40W/170	4	CCS
o	651	Linear Flake	0N40W/120	3	Jasper
p	656	Linear Flake	1S40W/140	3	Jasper
q	198	Linear Flake	0N39W/100	2	Jasper
r	658	Linear Flake	4S12W/10	2	Chalcedony
s	611	Linear Flake	10S2E/30	2	Chalcedony

Plate 3-3. Projectile points, linear flakes, shaft abraders, 45-DO-204.


0
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cm.
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r
s

Comment: This specimen was crudely roughed out on an elongate flake of light-colored, sugary quartzite. Percussion flaking has produced an irregular pattern of flake scars. The lateral margins evidence resharpening. It is debatable whether this form is properly termed a point, since its large size, crude manufacture and resharpened distal lateral margins may also suggest use as a knife.

Comparable Specimens: Collier et al. 1942: Plate I, j-m; Cressman 1960: Figure 41a, A,B; Nelson 1969: Figure 42, l,n; Rice 1972: Figure 21, c.

CASCADE C. (Plate 3-3;b)

Number of Specimens: 1

Provenience:	Material:	Measurement:
Zone 3	Jasper	3.0/1.4/.6 cm

Comment: This specimen is a squat, thick lanceolate form made on a flake of lightly banded jasper. Both the dorsal and ventral surfaces show an irregular pressure flaking pattern, although the basal portion has been carefully thinned.

Comparable Specimens: Leonhardy 1970: Figure 46, dd; Rice 1972:Figure 21, b,d; Chance and Chance 1982: Figure 166, d; Figure 169, b.

MAHKIN SHOULDERED LANCEOLATE. (Plate 3-3;c)

Number of Specimens: 1

Provenience:	Material:	Measurement:
Zone 3	Jasper	2.5/1.3/.5 cm

Comment: This specimen is a short, squat form made on a thick, primary flake. Pressure flaking pattern is irregular, and has not completely reduced the dorsal surface. The tip shows a small impact fracture, which has been reworked at the point. A lateral hinge fracture at the base has removed a small part of the stem.

Comparable Specimens: Cressman 1960: Figure 41a, C,K; Leonhardy 1970: Figure 46, a,b,d; Rice 1972: Figure 20, d; Chance and Chance 1982: Figure 163, e; Figure 164, c.

RABBIT ISLAND STEMMED A. (Plate 3-3;d)

Number of Specimens: 1

Provenience:	Material:	Measurement:

Zone 1	Jasper	4.0/1.6/.6 cm

Comment: This is a long, elegant form made on a large, thick flake with a pronounced triangular cross section. The straight lateral margins have deep, irregular serrations. The stem is contracting, narrow, and set slightly askew to the long axis of the point. Neither surface is completely reduced, but the pressure flaking pattern is fairly regular. Some smoothing of flake arrises at the stem and blade/haft juncture indicates that this specimen was hafted. A lateral break at the tip probably occurred during use.

Comparable Specimens: Cressman 1960: Figure 41b, D; Swanson 1962: Figure 36, e,f; Greengo 1982: Figure 3.6, l-n.

RABBIT ISLAND STEMMED B. (Plate 3-3;e,f)

Number of Specimens: 2

Provenience:	Material:	Measurement:
Zone 2	Jasper	2.5/1.7/.5 cm
Beach	Chalcedony	2.9/1.5/.4 cm

Comment: The jasper specimen is a short, squat triangular form made on a thick, twisted flake. Both the dorsal and ventral surfaces have been completely reduced through pressure flaking. The flaking pattern is variable, consisting of small flake scars of irregular carry and width. The sharply contracting stem has been thinned through removal of long, flute-like flakes from the dorsal surface. Some wear is visible at the tip of the point. The chalcedony specimen is an elongate, delicate triangular form made on a thin, symmetrical flake. Both surfaces have been uniformly reduced through pressure flaking, and the pattern is regular, with small, narrow flake scars carrying from the lateral margins well into the midsection of the point. A lateral snap has removed the tip of the blade. Lateral tangs at the shoulders and fine serrated lateral blade margins are present on both specimens.

Comparable Specimens: Cressman 1960: Figure 41b, D; Nelson 1969: Figure 41, b,c; Greengo 1982: Figure 3-6, e.

DETACHED BASE (Plate 3-3;j)

Number of Specimens: 1

Provenience:	Material:	Measurement:
Zone 1	Opal	- /1.3/.5 cm

Comment: This is a small, contracting basal fragment. A lateral, hinged snap has removed any evidence of the blade/haft juncture. Both the dorsal and ventral surfaces were pressure flaked, and the flake scar pattern appears irregular.

Comparable Specimens: None. Illustrated examples of Cascade C and Mahkin Shouldered projectile points, cited previously, are appropriate.

UNFINISHED PROJECTILE POINTS (Plate 3-3;g,h,i)

Number of Specimens: 4

Provenience:	Material:	Measurement:
Zone 3 (lanceolate)	Quartzite	- /1.9/1.0 cm
Zone 1 (lanceolate)	Jasper	- /1.4/.8 cm
Zone 4 (triangular)	Jasper	2.6/1.8/.6 cm
Zone 2 (triangular)	Jasper	- /1.5/.5 cm

Comment: The quartzite lanceolate specimen is made on a thick flake with a blocky cross section. Shaping flakes were removed by percussion--many terminate in abrupt step or hinge fractures. The striking platform is evident at the proximal end. A diagonal snap through the blade probably occurred during manufacture, since no wear is visible on edges or surfaces. The jasper lanceolate form was more carefully reduced. The pressure flaking pattern consists of regularly spaced collateral flake scars. Slight nibbling wear is apparent on the lateral and basal margins. A lateral snap removed the upper third of the blade. Both triangular specimens are made on broad, thick flakes. Manufacture appears to have begun at the tip and progressed toward the base in both instances. The basal margin of the smaller specimen was removed by a diagonal snap, which probably occurred during flaking. Neither specimen exhibits pronounced wear on cutting edges; however, some smoothing does occur on the broken tip of the larger form.

Comparable Specimens: None. Illustrated examples of Cascade A, Cascade C, and Mahkin Shouldered projectile points, cited previously, are appropriate for lanceolate specimens.

Figure 3-5 presents a regional chronology, with defined Rufus Woods Lake cultural phases compared to cultural phases and periods established by other researchers in nearby study areas. Projectile point types and associated radiocarbon dates place early site occupations in the latter part of the Kartar Phase (ca. 5000-4000 B.P.). The heaviest occupation, manifest in a well-defined living surface, contains a Rabbit Island Stemmed B point and dates to the latter part of the Hudnut Phase (ca. 3000-2000 B.P.). A marginal Cascade A point, a Rabbit Island Stemmed A point, and a lanceolate basal

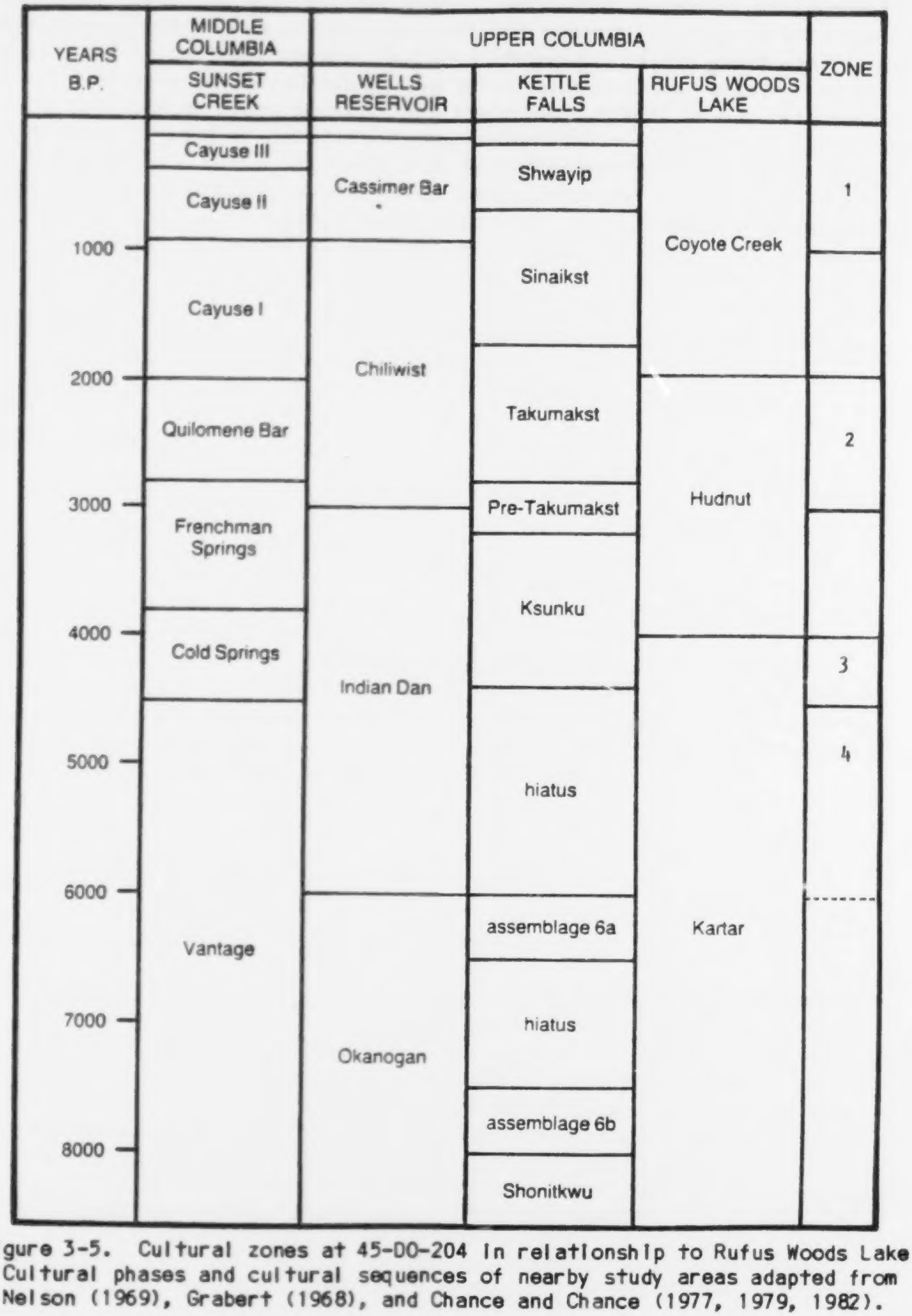
YEARS B.P.
MIDDLE COLUMBIA
SUNSET CREEK
UPPER COLUMBIA
WELLS RESERVOIR
KETTLE FALLS
RUFUS WOODS LAKE
ZONE
1000
2000
3000
4000
5000
6000
7000
8000
Cayuse III
Cayuse II
Cayuse I
Quilomene Bar
Frenchman Springs
Cold Springs
Vantage
Cassimer Bar
Chiliwist
Indian Dan
Okanogan
Shwayip
Sinaikst
Takumakst
Pre-Takumakst
Ksunku
hiatus
assemblage 6a
hiatus
assemblage 6b
Shonitkwu
Coyote Creek
Hudnut
Kartar
1
2
3
4

Figure 3-5. Cultural zones at 45-DO-204 in relationship to Rufus Woods Lake Cultural phases and cultural sequences of nearby study areas adapted from Nelson (1969), Grabert (1968), and Chance and Chance (1977, 1979, 1982).

fragment were recovered from Zone 1, which has radiocarbon dates placing the latest site occupation at about 600-500 years ago or within the Coyote Creek Phase. All three projectile points, however, reflect earlier periods, being found in contexts dating to the Kartar and Hudnut Phases elsewhere in the project area (Lohse 1984g). Since artifact distributions do not give any indication of mixing of older and younger occupations in Zone 1, and field records do not record disturbances of site deposits in the areas where the points were recovered, we must assume that their presence in Zone 1 is attributable to recycling by later site inhabitants.

4. FAUNAL ANALYSIS

Zoological remains from archaeological sites provide a unique source of data on the ecology and historic biogeography of animal species living in the site area, and on utilization of faunal resources by human occupants. This chapter describes the faunal assemblage recovered from 45-DO-204, and summarizes the implications of the assemblage for understanding the archaeology of the site.

FAUNAL ASSEMBLAGE

The distribution of faunal remains from 45-DO-204 by zone is summarized in Table 2-3. The assemblage consists of a total of 5,179 bone fragments weighing 899 g. Of these fragments, only 64, or slightly less than 2% of the sample, are identifiable due to the highly fragmented nature of the bones. Taxonomic composition and distribution of vertebrate remains for the site as a whole and by zone are shown in Table 4-1. The breakdown by taxa and element is given in Appendix B. Five fragments of shell, weighing 56 g, were recovered. Invertebrate materials have not been analyzed. The following summary lists the elements identified for each taxon and criteria used to identify them, where applicable. It also offers some remarks concerning past and present distribution and cultural significance.

SPECIES LIST

MAMMALS (NISP=53)

Lepus cf. *townsendii* (hares) -- 2 elements.

Two species of *Lepus* presently inhabit the project area, *L. townsendii* (white-tailed hare) and *L. californicus* (black-tailed hare). A third species, *L. americanus* (snowshoe hare), inhabits regions adjacent to the project area. These elements could not be assigned to species on the basis of morphological features. *L. californicus* is thought to have immigrated from the Great Basin during the early part of the twentieth century (Couch 1927; Dalquest 1948). *L. americanus* is largely nocturnal and secretive, and inhabits wooded areas. Consequently, these specimens have been tentatively assigned to *L.* cf. *townsendii*.

Table 4-1. Taxonomic composition and distribution of vertebrate remains from 45-DO-204.

Taxa	Zone								Site Total	
	1		2		3		4			
	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP[1]	MNI
MAMMALIA (NISP=53)										
Leporidae										
Lepus cf. *townsendii*			1	1	1	1			2	1
Sciuridae										
Marmota flaviventris			3	1	2	1			5	2
Geomyidae										
Thomomys talpoides			1	1	1	1	9	2	11	3
Heteromyidae										
Perognathus parvus	2	1					9	1	11	2
Cricetidae										
Peromyscus maniculatus	1	1					1	1	2	2
Microtus spp.			2	1			1	1	3	1
Lagurus curtatus			2	2	1	1	5	2	8	3
Mustelidae										
Mustela frenata[3]			1	1					1	1
Cervidae										
Odocoileus spp.	2	1	2	1	1	1			5	1
Deer-Sized			3						3	
REPTILIA (NISP=5)										
Chelydridae										
Chrysemys picta					5	1			5	1
AMPHIBIA (NISP=6)										
Ranidae/Bufonidae							6	1	6	1
TOTAL IDENTIFIED SPECIMENS	5		16		12		31		64	
TOTAL FRAGMENTS	523		2,318		1,635		703		5,179	

---

[1] NISP = Number of Identified Specimens

[2] MNI = Minimum Number of Individuals

[3] NISP for *Mustella frenata* counts as one element on entire skeleton for which the individual elements were not counted separately.

Marmota flaviventris (yellow-bellied marmot) -- 5 elements.

All marmot remains have been tentatively assigned to the species *M. flaviventris* on the basis of present distribution. This species is the only marmot now living in the project area, and is a common resident of talus slopes. Marmots were exploited as a small game resource by ethnographic inhabitants of eastern Washington (Ray 1932; Post, in Spier 1938). Their presence in this faunal assemblage may indicate prehistoric exploitation.

Thomomys talpoides (northern pocket gopher) -- 11 elements.

Thomomys talpoides is the only geomyid rodent in the project area. Because pocket gophers are extremely fossorial and there is very little evidence that they were utilized prehistorically or ethnographically, their presence in this assemblage may be considered fortuitous.

Perognathus parvus (Great Basin pocket mouse) -- 11 elements.

Perognathus parvus is the only heteromyid rodent known in the project area. Like the pocket gophers, *P. parvus* is most likely present as a result of natural agents of deposition.

Peromyscus maniculatus (deer mouse) -- 2 elements.

Deer mice are residents of all habitat types in the project area. There is no evidence that deer mice were ever utilized.

Microtus spp. (meadow mouse) -- 3 elements.

Three species of *Microtus* occur in the site area. None of the elements recovered could be assigned to species. Meadow mice occur in grass and marsh habitats. There is no indication that these elements were culturally deposited.

Lagurus curtatus (sagebrush vole) -- 8 elements.

Sagebrush voles inhabit dry sagebrush areas with little grass (Maser and Storm 1970:142). Only cranial material of this species is distinguishable from *Microtus* sp. The occlusal surface of M^3 (Maser and Storm 1970) and the location of the mandibular foramen (Grayson 1982) are distinctive.

Mustela frenata (long-tailed weasel) -- 1 element.

Weasels are ubiquitous in Washington, and are very active predators known to follow prey species such as gophers into their burrows. There is ethnographic evidence that weasel skins were used as decorations on garments (Ray 1932:49-50).

Odocoileus spp. (deer) -- 5 elements.

Two species of deer may be represented in this site, *O. hemionus* (mule deer) and *O. virginianus* (white-tailed deer). It was not possible to assign any recovered elements to one of these species. Deer are thought to have represented a major food resource to the prehistoric inhabitants of eastern Washington (Gustafson 1972), as they did for the ethnographically known cultures (Post, in Spier 1938; Ray 1932)

Deer-Sized (deer, sheep, antelope) -- 3 elements.

Fragmentary elements of deer, sheep, and antelope frequently are missing the characteristics that distinguish the three taxa. Such elements have been grouped under the label deer-sized.

REPTILES (NISP= 5)

Chrysemys picta (painted turtle) -- 5 elements.

Painted turtle is the only turtle currently living in the project area. *Clemmys marmorata* (western pond turtle) has been reported in the eastern part of Washington in the ethnographic literature (Ray 1932:87), but this would represent a major extension of its known range. At the present, *C. marmorata* occur only on the west side of the Cascades and in the southern part of the state. Because we do not know if any other turtle has lived in the project area nor if turtles were ever imported, all turtle remains have been assigned to *C. picta*. The turtle shell in this assemblage is too fragmentary to determine whether it is carapace or plastron.

AMPHIBIA (NISP= 6)

Family Ranidae/Bufonidae (frogs/toads) -- 6 elements.

Both frogs and toads inhabit the project area (Stebbins 1966). Inadequate comparative material precluded assigning these elements to the correct Family.

DISCUSSION

The identifiable assemblage from this site is very small, and none of the identifiable fragments exhibit evidence of alteration such as butchering marks or burning which might indicate cultural use. However, unidentifiable fragments from Zone 2 exhibited evidence of both butchering and burning. All identified taxa occur in the site area at present. The rodent and mustelid elements were most likely incorporated into the deposits by natural processes. The hare, large mammal, and turtle elements are not as likely to have been deposited by natural processes, but we cannot rule out the possibility of natural deposition in a sample of this size. Deer and deer-sized taxa may be the source of most of the unidentifiable fragments.

Among these elements, there are two seasonal indicators: marmot elements recovered from Zones 2 and 3, and turtle elements recovered from Zone 3. Marmots are active during spring and early summer, while turtles are active from March to November. If these two taxa were deposited in this site as a result of cultural activity then they may indicate that when Zones 2 and 3 were deposited this site was occupied during at least spring and/or early summer.

5. BOTANICAL ANALYSIS

The study of vegetable materials found in archaeological matrices, termed archaeobotany or paleoethnobotany, (Dennel 1976; Dimbleby 1967; Ford 1979; Renfrew 1973) provide valuable information about the resource base of peoples who inhabited a site. With lithic and faunal materials, they give us the means for making inferences about the peoples' patterns of subsistence, as well as interpreting site features. The presence and condition of specific kinds of fruit seeds and flower parts, for instance, can suggest seasonality of site use.

Two kinds of flotation samples were available from 45-DO-204: those from testing, which averaged only 270 g of soil, and those taken from features during full-scale data recovery, which averaged 1.8 kg of soil. Only sugar flotation was used on the former; the latter were subjected both to river flotation and to sugar flotation. We rarely used subsampling at this site. In order to compare the two kinds of samples nearly all their carbon was examined.

Flotation samples were taken from each unit level of testing units 3N50W, 1S44W and 3N30W. Figure 5-1 shows carbon percentages in these samples by 10-cm levels. The graphs show definite valleys and peaks ranging from no carbon to 2.4%. Carbon percentages in several levels exceed 0.01%. The carbon peaks in 3N50W and 1S44W occur in ULs 50 through 70. The varied materials from these levels suggest occupational debris. Unit 1S44W has a second peak in levels 90 and 100, the approximate depth of Feature 1 in unit 2N42W, 2 m to the north.

The samples with a carbon content from approximately 0.01% to 0.1% may indicate general camp or cultural activities; a carbon content 1.0% or more may indicate a feature of some kind. Samples with less than 0.01% carbon are not very informative concerning cultural activity.

THE BOTANICAL ASSEMBLAGE

The botanical assemblage from 45-DO-204 was taken from 57 flotation samples from five excavation units in Zones 1, 2, 3, and 4. The samples range in elevation from +20 cm to 170 cm b.u.d. (below unit datum). In addition, four carbon samples taken from Features 1 and 2 for possible radiocarbon dating were examined. The flotation material, slightly more than 196 g, was extracted from 21.86 kg of soil, yielding a site carbon:noncarbon ratio of 0.9% for all materials ranging in date from about 4600 years B.P. to the present.

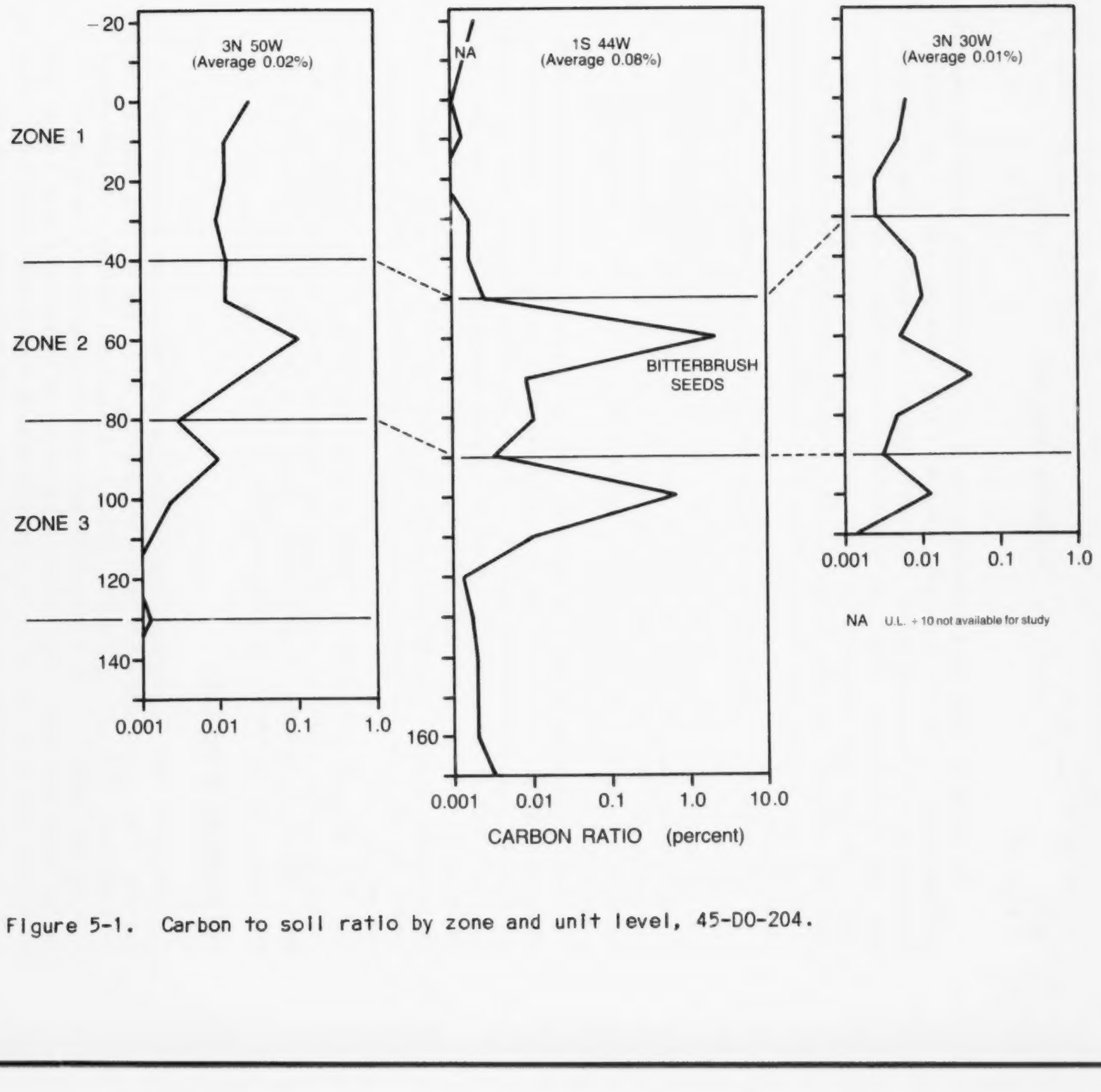

Figure 5-1. Carbon to soil ratio by zone and unit level, 45-DO-204.

The botanical materials are distributed among five families, 10 genera, and eight species. One genus (*Chenopodium*), one species (*Rosa woodsii*), and one family (Apiaceae) are tentative additions. Table 5-1 shows percentage of carbon in flotation samples by analytic zone and radiocarbon years. Table 5-2 shows the total assemblage by zone, category weight, and number of appearances. In these tables, flotation samples from features are separated from those from unit levels in order to compare them. Eight flotation samples taken from two hearths replete with carbon yielded 188.4 g of archaeobotanical remains from 8.6 kg of soil, an average of 2.2% carbon. The 49 flotation samples taken from testing units 3N50W, 1S44W, and 3N30W yielded 7.7 g of charred remains from 12.5 kg of soil, or an average carbon content of 0.06%. Most of this material is from Zone 2.

Table 5-1. Percentage of archaeological carbon in flotation samples by zone, depth and radiocarbon age.

Zone	Radiocarbon[1] Date	% Carbon		Approximate Depth below Surface
		Unit Levels	Features	
1	592± 71 655± 67	0.010	0.044	50 cm
2	2812±344	0.020	0.150	100 cm
3	4590±145	0.010	-	150 cm

[1] For additional estimation on radiocarbon date samples see Appendix A, Table A-1.

The assemblage contains considerable amounts of woody tissue (woods, bark, cones), most of it from Features 1 and 2. Nearly all of the wood is yellow pine (*Pinus ponderosa*, ponderosa pine, and *P. contorta*, lodgepole pine) and Douglas fir (*Pseudotsuga menziesii*). Nearly 70% of all samples contain either bark and/or cone tissue. Pine wood is found in charred and incompletely charred state in Feature 2, a 600 year old hearth containing pine seeds and other edible plant remains. Much of this conifer wood is found in samples with bark, which may indicate either that the wood was freshly cut or that bark was collected deliberately. The cone fragments probably are from ponderosa pine. They seem robust enough for ponderosa cones; however, all the pieces are fragmentary, and most of the fragments show signs of deterioration. Surface cell layers often are missing on cone scales, and none of the thickened ends are intact. Condition precludes distinguishing between ponderosa and lodgepole in many cases. While cone material is found in all zones, it is particularly abundant in Feature 1.

Table 5-2. The botanical assemblage by flotation weight (g) and number of appearances (#), 45-DO-204.

Identifiable Bontanical Material	Zone										Total	
	1				2		3					
	Unit Levels (N=15)		Feature 2 (N=5)		(N=15)		Unit Levels (N=18)		Feature 1 (N=3)			
	g	#	g	#	g	#	g	#	g	#	g	#
Conifer (94%)												
Pine	0.01	3	89.91	8	0.17	7	0.04	5			90.13	23
Fir	0.03	5	0.08	1	0.09	7	<0.01	2			0.20	15
Pinaceae	<0.01	3	6.68	1	0.02	5	0.02	5			6.72	14
Bark	<0.01	1	24.72	5	0.08	11	0.01	5			24.81	22
Cone			0.31	3	0.04	9	0.01	4	62.53	3	62.89	19
Other	<0.01	3			0.01	4	0.01	5			0.02	12
Hardwood (<1%)												
Sage	0.01	3			<0.01	1					0.01	4
Rabbitbrush	<0.01	1									<0.01	1
Bitterbrush	0.01	4	0.03	1	0.01	3	0.01	4	<0.01	1	0.06	13
Hawthorn			0.06	1							0.06	1
Serv/Haw			<0.01	1			0.01	1			0.01	2
Rosaceae	<0.01	2			<0.01	3	<0.01	1			<0.01	1
Other	0.01	5			<0.01	2	0.01	2			0.02	9
Edible Materials (2%)												
Seeds	0.01	1	3.40	1					0.16	2	3.57	4
Other	0.01	1	0.10	1			0.01	1			0.12	3
Other Tissue (4%)												
Seeds	0.16	14	0.02	3	6.39	8	0.25	3			6.82	28
Grass	<0.01	1	<0.01	1	<0.01	1					<0.01	3
Herbaceous stem	0.02	7			0.01	6	<0.01	2			0.03	15
Nonwoody	0.04	15	0.36	4	0.05	11	0.04	16			0.49	46
TOTAL	0.31		125.67		6.87		0.42		62.69		195.96	

Comprising less than 1% of the samples, hardwoods are rare at 45-DO-204. Sage, which we have come to expect, is present in only four flotation samples and is absent entirely from Zone 3. Rabbitbrush is found only in a single sample from Zone 1. Bitterbrush is the most common hardwood in all zones. At 0.06 g, however, the wood scarcely seems to have been a major fuel, although it appears in small quantities in 29% of the flots. Bitterbrush seeds are much more common than the wood (see below). The only other identified hardwood is a single specimen of hawthorn from Feature 2 in Zone 1. Two fragments of rosaceous shrub, which may be either serviceberry or hawthorn wood (Serv/Haw), come from Zones 1 and 2; other unidentifiable members of Rosaceae also were recovered from Zones 1, 2, and 3. A few pieces of hardwood charcoal that cannot be precisely identified complete the hardwood inventory.

The relative lack of hardwood charcoal is intriguing. At present, sage and bitterbrush grow at the site, and large amounts of both hardwood and conifer driftwood are available on the beach. If present conditions resemble those of the past, visitors to 45-DO-204 would have had a variety of woods to choose from. Pine wood and pine products were, however, consistently preferred.

Edible and other nonwoody tissues form 6% of the assemblage. Seeds and seed wall fragments weigh more than 10 g and are found in 18 of the 57 flots. Identified kinds include pine, bitterbrush, plantain (Plantago sp.), a native wild flower (Phacelia sp.), and several unidentifiable fragments. With the exception of some, which may be bitterbrush, most of the unknown fragments do not appear to have been from economically important seeds.

Bitterbrush seeds, the most common, are found in 10 flotation samples from all levels. Among the 550 seeds recovered were a concentration of several hundred seeds in Zone 2 and a group of 34 in Zone 3.

Pine seeds, which weigh more per seed than bitterbrush seeds, occur in three flotation samples from Features 1 and 2. Those from Feature 1, in Zone 3, were found among a large quantity of cone debris. Those from Feature 2, in Zone 1, were found with very little cone material and a great deal of pine wood.

Apart from pine seeds, edible material includes a relatively large sample of peeled or stripped plant cortex (or pith) from Feature 2 and two possible examples of root material from Zones 2 and 3. One of the samples from Zone 2 may be from the parsley family (Apiaceae or Umbelliferae), but this is far from certain. The identity of the other is unknown.

The remaining botanical materials consist of nonwoody tissues such as traces of grass, stem and leaf parts, and a residual category of epithelioid and parenchymoid tissue that cannot be assigned elsewhere. In general, this last category is large in the sugar flots in all zones but small in the two features. On the whole, the presence of these tissues shows that preservation of botanical materials is excellent, even in deep unit levels. Grass is not common at the site, and the lack of it is curious, considering that grass is quite common at other sites.

It is rare to find that nonwoody tissues (nonedible seeds included) outweigh woods in flotation samples as they do at 45-DO-204. There are no trends other than that at the site, and no noticeable changes through time.

The assemblage from flotation samples and radiocarbon samples is presented below arranged alphabetically by family, genus, and species. Possible uses are suggested from information supplied by ethnographic, ethnobotanical, and medical botanical sources. Seasonality data are included where available.

ASTERACEAE (Composite, Daisy Family)

Artemisia tridentata Nutt. (sagebrush, big sage)

Sage charcoal is not common at the site. A small sample was found in Zone 1, and a trace was discovered in Zone 2. So little sage (0.01 g) in a site with several dozen flotation samples is surprising. Sage wood is valuable primarily as fuel (Turner et al. 1980:79), rather than for construction material, but those who occupied the site apparently did not use much of it.

Chrysothamnus nauseosus (Pall.) Britt. (rabbitbrush)

One flotation sample from Zone 1 contained a trace of this small shrub. Since rabbitbrush is commonly found at the site and so little was recovered, no special significance is attached to its presence.

HYDROPHYLLACEAE (Waterleaf Family)

Phacelia linearis (Pursh) Holz. (Phacelia)

A charred nutlet from this showy native wildflower was found in Zone 1. The tiny nutlet is only 1.1 mm long and is conspicuously pitted. The end of the nutlet has been opened, either through natural germination or animal disturbance. The seed was found in UL 10 and probably is quite recent. Ethnographic literature does not document any known use for the plant.

PINACEAE (Pine Family)

Pine is the most common wood at 45-DO-204. It occurs in 40% of the flotation samples in all zones and features. Most of the specimens are ponderosa pine (Pinus ponderosa), but lodgepole pine (Pinus contorta) is represented as well. While lodgepole can be distinguished from ponderosa pine in bole wood, the two are difficult to tell apart in samples which contain mixed branch and bole material. If there is uncertainty about the composition, we have designated a mixed sample as yellow pine to cover both woods. There is little harm in doing so, since the woods are similar in structure and working properties and could be used interchangeably for many activities. Ponderosa is perhaps more accessible than lodgepole today. It tolerates slightly drier conditions and descends to lower elevations than lodgepole pine. Ponderosa trees can be seen south of the site on hillsides at about 600 m m.s.l.

Twenty-five percent of the flotation samples contain wood that can be identified only to the family Pinaceae. The group probably is composed largely of ponderosa and lodgepole pine, but larch and spruce may also be present. A portion of a conifer needle with a square cross section, probably from a spruce, was found in Zone 1 (flotation sample 41).

The categories Pinaceae and Other Conifer have a large membership because of the initial small weight of soil taken for flotation samples. We had to work with tiny bits of charcoal and so we often could not see some of the finer characteristics that would allow us to assign the specimens to genus.

The remaining conifer tissue consists of bark and cone fragments. Most of the weight is from Features 1 and 2, but small amounts of cone and bark tissue are found in all zones. Cone fragments are found in 32% and bark in 39% of the flotation samples. While we cannot distinguish bark by genus, the cone fragments suggest ponderosa pine.

Site 45-DO-204 is the first site in the project area where pine seeds were found. Nearly all of the seeds are from Features 1 and 2. Most of the estimated 785 seeds are represented by fragmented seed coat material. Very few were found intact. Three are shown in Plate 5-1; Plate 5-2 shows both modern and archaeological seed for comparison. Feature 1 has 15 seeds and more than enough cone material by weight to account for them as casual introductions along with the cone material (the weight of seed material in this feature is less than 5% of that of the cone material).

The estimated 170 to 240 pine seeds (3.4 g) from Feature 2 are not matched by a correspondingly large sample of cone material. In this feature, the weight of cone material is less than 1% of that of the seeds. Our experiments suggest that cones suitable for burning may still have seeds in them. The largest number (35 in one small cone from a beach) consititued 5% of the cone's dry weight. Fresh seeds from harvested cones constituted from 2% to 7% of the cone material. Feature 2 seeds should have come from cones collectively weighing over 300 g (USDA 1974:Table 6). The small amount of cone material here suggests that the seeds were harvested and the cones deposited elsewhere.

Pine probably was the major fuel throughout the site's long history. It may have been used for other activities too. Pines have many documented uses in the ethnographic literature: cambium and seeds were consumed, and pitch made waterproof cement and a base for medicinal salves and ointments. Boiled needles and branch tips served as internal medicine and as external washes (Ray 1932:221; Turner et al. 1980:32-34). The wood was a major material for dugouts and firedrills (Ray 1932; Post and Commons, in Spier 1938:56,59).

Plate 5-1. Pine seeds from Feature 2, Zone 1, 45-DO-204 (10X).

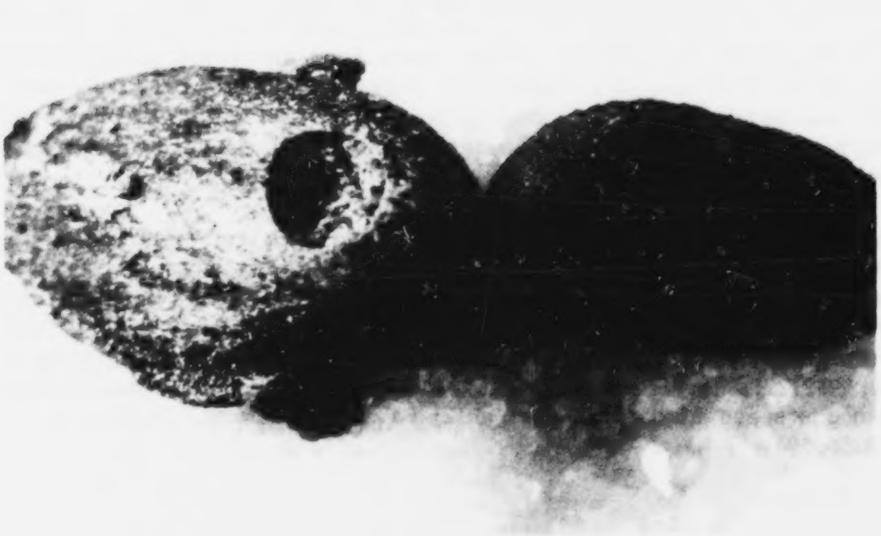

Plate 5-2. Modern ponderosa pine seed (left) (10X) and archaeological pine seed from 45-DO-204 (right) (10X). Both seeds have insect entry holes.

Pseudotsuga menziesii (Mirb.) Franco (Douglas fir)

Douglas fir is the second most common conifer present at the site. It is found in 26% of the samples. In weight it appears to be a poor second to pine. If we ignore the very large sample of pine from Feature 2 (about 90 g), however, its weight (approximately 0.2 g) closely approaches that of pine. Fir is well represented in flotation samples from Zones 1 and 2. A trace is found in Zone 3. At present, fir grows among ponderosa pines at elevations above 600 m. A few trees can also be seen near water's edge upstream at RM 578.

Fir was a preferred wood for harpoon and spear shafts because long, straight staves made from it would not warp or absorb water (Post and Commons, in Spier 1938:55-56). Fir boughs provided flooring and temporary shelter material in dwellings and sweat lodges and were used as scrubbing material during sweats. Bough tips, needles and bark were said to be useful in reducing fever and alleviating a variety of other complaints (Turner et al. 1980:35).

PLANTAGINACEAE (Plantago or Plantain Family)

Plantago patagonica Jacq. (sagebrush plantain)

An entire native plantain seed was found in Flotation Sample 41 from Zone 1. This small, inconspicuous annual is very common under sage and bitterbrush on river terraces and open hillsides. According to Turner, the leaves of the plant were mashed and used as a poultice (Turner et al. 1980:111). Plantain seeds are expected in study area flotation samples because the plants are numerous across sites, and seeds could easily have become incorporated by accident.

POACEAE (Gramineae, Grass Family)

Traces of grass were found in Feature 2 in Zone 1 and also in Zone 3. Grass from 45-DO-204 is rather conspicuous because of its small quantity and few appearances. Preservation at this site is good, and the tissue should have found its way into the samples if it was brought to the site.

ROSACEAE (Rose Family)

Crataegus sp. (hawthorn)

The only hawthorn wood at the site was found in Feature 2 in Zone 1. Other examples may exist as part of the serviceberry/hawthorn (Serv/Haw) category. At 0.06 g, hawthorn equals bitterbrush in weight but not in number of appearances. As in other sites, hawthorn is not a common wood. Thorns would make collecting branches for firewood difficult. The wood, however, was used in the past for making digging sticks and other small articles (Turner et al. 1980:125).

Purshia tridentata (Pursh) DC. (bitterbrush, greasewood)

The remains of bitterbrush wood and seeds are found in all zones and in Features 1 and 2 at 45-DO-204. Weighing 0.06 g and appearing in 23% of the flotation samples, the wood is the most common hardwood found. As mentioned earlier, it has been usual to find bitterbrush with sage charcoal at other sites, but this is not the case at 45-DO-204. Here it is found with pine or fir instead.

The more than 600 bitterbrush achenes, which weighed 6.8 g and were found in 21% of the samples, are the most important seeds from the site. The prevalence of the seeds suggests repeated summer occupancy. Bitterbrush grows on the site, where it is now mixed with sagebrush. It blooms in May and sheds its seeds over a brief period in late June or early July.

An estimated 573 charred and broken achenes were taken from testing unit 1S44W in UL 60 (Sample 49, carbon ratio 2.4%). A second sample from that level also contained traces of ponderosa pine, conifer barks and cone material, sage, and some nonwoody tissue. Carbon ratios above and below this level are moderate at 0.01% and just under 0.04% repectively; thus, the seeds stand out as a peak of abundance in a level that does not contain much other material.

The question arises whether the seeds are cultural. They are not known to be edible by humans; medicinal uses attested ethnographically (Ray 1932:217) may be risky (Lewis and Elvin-Lewis 1977:14,18). The only other known use for the seeds is for making a red dye (Chamberlain 1892, reported in Turner 1979:242). The amount of seeds compared to wood suggests that some, at least, were collected deliberately, and both flotation samples from UL 60 show little, if any, nonhuman disturbance. The fact that the achenes were charred after having been stripped of their enclosing husks indicates human activity. Furthermore, the soil surrounding the concentration is not as bare as it seems. Testing unit 3N50W to the northwest has a botanical peak in carbon at about the same level as the seeds (Feature 4, an occupation layer dated about 2812±344) Unit 2N40W to the northeast has another botanical peak two unit levels below the seeds (Feature 1) dated about 4590±143. The seeds may well be associated with Feature 4.

In both the number of achenes (roughly 550) and its location outside a main feature or activity area, this concentration resembles the one found at 45-OK-288. This cache, however, is considerably older (about 3000 B.P.) than the one from 45-OK-288 (about 600 B.P.).

Finally, a group of 34 bitterbrush achenes with a weight of 0.25 g was found in the same unit (1S44W) 40 cm below the larger concentration (UL 100). These seeds were found with other charred materials, including Douglas fir, bitterbrush, serviceberry, hawthorn (Serv/Haw) wood, and samples of conifer cone material, unknown conifer, and a diffuse hardwood. The carbon content was high (0.2%), considering that the sample may be as old as 4600 B.P. The achenes seem to form part of occupational debris, the oldest in our flotation samples from the site.

Rosa sp. (wild rose)

Fragments from two bony, angular seed walls, probably from a local wild rose (Rosa woodsii Lindl.), were found in Sample 18 from Zone 1. They were found with a variety of woods and nonwoody tissue, and the carbon ratio was high (0.04%), which suggests occupation.

Rose hips can be picked in the late autumn throughout winter and often until late spring. By spring, however, the fruits are shriveled, brown, and inedible. Hips are edible in fresh or dried state, although in this region they were said to be used strictly as famine food (Ray 1932:108) and then in small amounts (Turner et al. 1980:152). Rose terminal end branches seem to have had much more use than the fruits. Branches were used to dispel spirits in burial ceremonies (Ray 1932:131), leaves were used to protect and flavor food in pit cooking, and the terminal portion of stems and leaves made teas for washes, sweats, hunting rituals, and the like (Turner et al. 1980:151).

Serviceberry/Hawthorn (Serv/Haw) and remaining Rosaceae

The remaining hardwoods constitute 0.03 g from 17 flotation samples, or 30% of the samples. These consist of small bits of serviceberry or hawthorn wood (Serv/Haw) that lack features (mostly clearly defined rays) necessary for positive diagnosis. Both woods are found locally in draw communities, along talus slopes, and as isolated individuals scattered on terraces. Both are shrubs, although hawthorn can become tree-like in ideal habitats. Both produce edible fruits, and both produce tough, elastic wood suitable for small, utilitarian articles. Neither genus grows on the site at present, but the wood can be found as driftwood or retrieved from individuals within an hour's walk from the river. The dried wood makes good fuel, and fresh branches would have made good coverings for structures, shade, or steam pit packing, where the thorns of the haw would not have been objectionable.

Rosaceous woods probably include even smaller bits of serviceberry, hawthorn, rose, bitterbrush, and wild cherry wood. These species are difficult to tell apart when samples are tiny, having similar features under the microscrope. The category is not large at 45-DO-204, and presumably unimportant.

Other Hardwoods

The last of the hardwood categories consists of two unknown woods: a diffuse porous hardwood and two samples of wood with pore clusters and pore multiples. Many woods have such features, but they are not distinguished by them. "Other" is a residual category for items we know are not conifer wood.

UNIDENTIFIED SEEDS.

Unidentified seed fragments fall into three descriptive categories: (1) spongy, having a cell structure that gives the coat a leathery texture, (2) dense, having a hard, tough texture, and (3) other, a residual category. Bitterbrush and pine seed walls provide examples of spongy texture. The group is found in nine samples from all zones and features and weighs 0.04 g. Six fragments come from samples that have bitterbrush seeds or from samples that are within a unit level from samples that contain bitterbrush. We suspect that more than half of this group is bitterbrush seeds. Examples of seeds with dense coats are hawthorn and cherry pits. Dense concentrations of fragments are found in seven samples from all zones and weigh 0.02 g. One of these from Zone 1 (Flot 41) may be from goosefoot (Chenopodium sp.). Other seed fragments weigh less than 0.01 g and consist of two examples from Zone 2.

STEM AND LEAF TISSUE.

Finally, a small amount of dicot stem is reported from Zone 1, Feature 2, and from Zones 2 and 3, along with a few fragments of leaf tissue in Zone 1. Nonwoody tissues, an aggregated group made from parenchymoid and epithelioid tissues weigh little but are present in over 80% of the samples. Possible underground root tissue, which resembles Lomatium root but is too small (0.01 g) to identify positively, was found in Sample 17 in Zone 3, Unit 3N30W. A relatively large sample of peeled stem cortex, shown in Plates 5-3 and 5-4, comes from Feature 2 (Sample 62). Most of the vascular tissue has been removed from the periphery, leaving softer tissue exposed. The arrangement of the vascular tissue appears to be of the concentric type (Esau 1965:368), an arrangement shared by some grasses and dicots. The stripping off of the stem's outer layer suggests deliberate action. Both this tissue and rootlike samples have been placed in the "Other Edible" category in Table 5-2.

SUMMARY BY ZONE

Botanical materials from 45-DO-204 are summarized below by analytic zone.

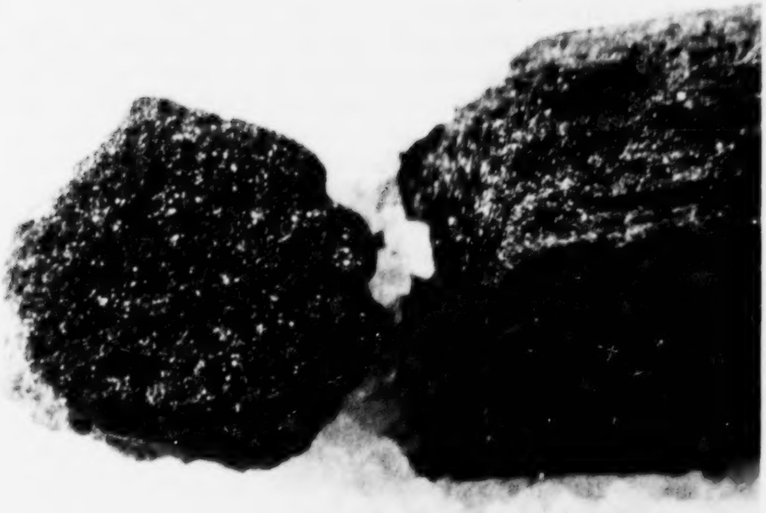

Plate 5-3. Plant cortex, longitudinal and cross sections, Feature 2, Zone 1, 45-DO-204 (10X).

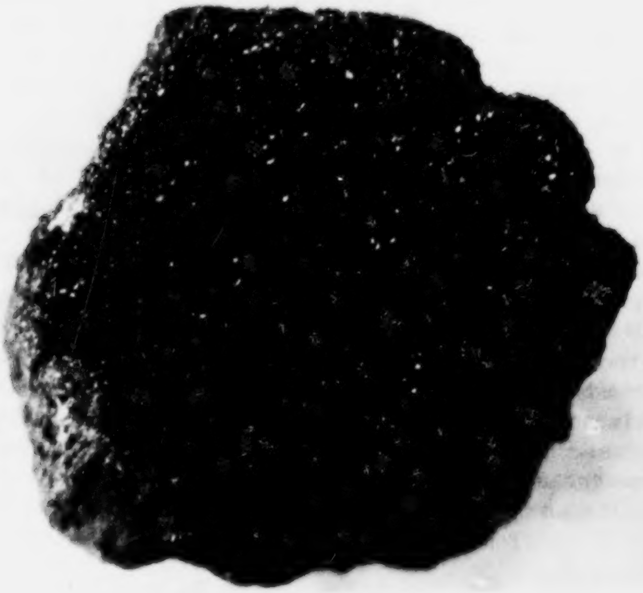

Plate 5-4. Plant cortex closeup (20X).

ZONE 4 (Kartar Phase, pre-4500 B.P.)

A single flotation sample (34) from 3N50W contained a trace of bitterbrush charcoal from UL 150. In 1S44W, the zone boundary is unclear, and no attempt was made to delineate Zone 4 in this unit, where samples were taken to UL 170. Materials consist of traces of pine, unknown conifer, and nonwoody herbaceous tissue.

ZONE 3 (Kartar Phase, ca. 4500-4000 B.P.)

Zone 3 is represented by 18 flotation samples from the three test units, three flotation samples from Feature 1, dated to 4590±143, and one radiocarbon sample (M#1).

Unit Level Materials

The botanical assemblage from unit level materials consists of 12% conifer, 7% hardwood, 2% edible material, and 69% seeds and other nonwoody tissue (Table 5-2). The conifer wood is mostly undifferentiated yellow pine with a small amount of bark, cone fragments (no seeds), and a trace of Douglas fir charcoal. The hardwoods consist of almost equal amounts of bitterbrush, rosaceous shrubs, and an unknown hardwood. Bitterbrush seeds (N=24, 0.25 g) weigh more than any other category in Zone 3. Most of these seeds come from a single flotation sample (53) from 1S44W, UL 100. Unit levels 90 and 100 in the same unit have carbon contents of 0.18% and 0.01% respectively, the highest for test units in Zone 3. Unit 3N30W also shows a carbon peak in UL 100 (0.02%) and possible root tissue (0.01 g) in UL 110. These two units may reflect activity surrounding Feature 1 in salvage unit 2N42W.

Materials From Feature 1

The fill of Feature 1, a shallow circular pit, was entirely extracted and subjected to flotation (Samples 1, 2, 3) with the exception of charcoal used for radiocarbon dating. One of the carbon samples (C.S.2) yielded a date of 4590±143. The other (C.S.1), from UL 70, consisted of 2.5 g of conifer cone fragments with seeds. Seeds make up 1% of the cone tissue. The three flotation samples, derived from 4.2 kg of soil, yielded 62.5 g of cone fragments, 0.01 g of pine seeds, and two bitterbrush fragments. The pine seeds (N=17), including those from the carbon sample, could have come from one cone. The bitterbrush seeds indicate summer burning. This is the only hearth studied for this project which contained no wood, and we suspect the cones were used as fuel. The carbon purity (88%-99%) and the carbon ratio (1.5%) are high, given the age and depth (UL 70-80) of the feature.

ZONE 2 (Hudnut Phase, ca. 3000-2000 B.P.)

Fifteen flotation samples were analyzed from Zone 2. Approximately 6.87 g of carbon were extracted from 3.5 kg of soil for a zone average of 0.02%. Samples ranged from 0.0005% to 2.4% carbon. The high percentage comes from the sample that yielded the large concentration of charred bitterbrush achenes (1S44W, UL 60). A carbon sample dates portions of this zone to 2812±344.

The Zone 2 botanical assemblage (Table 5-2) consists of 6% conifer wood, less than 1% hardwood, and 94% seeds and other tissue. Without the concentration of bitterbrush seeds, the assemblage consists of 82% conifer, mostly pine, 2% hardwood, mostly bitterbrush, and 16% seed fragments and bits of nonwoody tissue.

The unit that yielded the most botanical remains, 3N50W, has its greatest concentration of such remains in UL 60, where the carbon content reaches 0.1%. The three flotation samples from levels 50, 60, and 70 contain fairly large quantities of carbonized remains. They also contain a great deal of conifer material (95%), a little bitterbrush hardwood (4%) and traces of grass, bitterbrush seeds, and a few pieces of parenchymoid tissue. Ponderosa pine accounts for most of the conifer material, although Douglas fir is present in substantial amounts, as well as some undifferentiated yellow pine, pine cone material, and bark. No pine seeds were encountered. The test unit to the east of these, 3N30W, has some carbon, but too little to discuss in detail.

ZONE 1 (Coyote Creek Phase, ca. 600 B.P.)

Zone 1 is represented by 15 flotation samples from three testing units and five flotation samples from Feature 2 in 6N23.5W. The feature also yielded about 150 g of pine, mostly lodgepole branches, in the form of carbon samples. The difference between the carbon content of feature flots (2.7%) and that of samples from test units in this zone (0.01%) illustrates the disparity between feature and nonfeature soil.

Unit Level Materials

Conifer constitutes 13% of the botanical materials from Zone 1, hardwood 10%, edibles about 6%, and seeds and other tissues 71% by weight (Table 5-2). Douglas fir is the most prominent conifer wood. Pine consists of a trace of ponderosa pine and 0.01 g of lodgepole pine. A charred fragment of conifer leaf that resembles a spruce needle in cross section was found at the top of the layer (1S44W, UL +20) in the same flotation sample as a complete plantain nutlet. The latter is local; the former is not. Most of the seeds are bitterbrush (N=18, 0.12 g). All but two are from three unit level flotation samples from 3N50W. Two rose seeds (0.01 g), placed in the edible category in Table 5-2, and a phacelia nutlet come from the same unit.

Materials From Feature 2

Feature 2 was encountered and partially excavated during testing (testing Feature 1). One carbon sample, consisting of 21.5 g of incompletely charred lodgepole pine branchwood, was dated to 655±67 B.P. Another sample, not available for botanical identification, was dated at 592±71 B.P. The remaining carbon samples from the testing phase consist of 7.13 g of ponderosa pine and 103.4 g of incompletely carbonized lodgepole pine branches, which have diameters from about 2 cm to 4 cm.

The feature's botanical remains consist mostly of pine charcoal and pine bark. The pine is a mixture of charred and incompletely burned ponderosa (94 g) and lodgepole branches (123 g), the former more prevalent in the flotation samples and the latter more common in the carbon samples. The top of the feature yielded fragments representing at least 170 and possibly as many as 250 seeds, probably ponderosa pine. Most of the herbaceous material appears in the lower portions of the feature, along with small amounts of shrubby rosaceous species, such as hawthorn and possibly serviceberry. The bulk of nonwoody material consists of small grass stems, herbaceous stem, leaf, and bits of seed or fruit coat and parenchyma tissue that cannot be specifically identified. Peeled plant cortex in the middle of the feature may be edible material. Bitterbrush charcoal is present along with two broken and charred bitterbrush seeds. These seeds and the plant cortex suggest summer burning. Clearly, some planning and preparation went into the making of the feature. The materials are stratified with the bulk of the pine fuel at the top, and most of the other material in the middle and bottom. Such would be the arrangement if trash were used to kindle the fire or leafy material to enclose food bundles. The peeled plant cortex and the many pine seeds unaccompanied by cone fragments suggest an oven where food was prepared.

6. FEATURE ANALYSIS AND ARTIFACT DISTIBUTIONS

Analysis of finer temporal units and spatial distributions of artifacts and features within the zone is an important adjunct to the broad comparisons of zonal content made in the preceding chapters. The analytic zones necessarily span relatively long periods because finer temporal distinctions cannot be reliably correlated across the site. The zones combine the material products of numerous short-term activities, thus obscuring much small scale temporal and spatial variability in cultural activities. The detailed descriptions of individual features and localized artifact distributions in this chapter supplement the zonal descriptions.

FEATURES

Knowledge of the structure and content of features increases our understanding of the prehistoric activities that took place at the site. Consequently, features were excavated separately, and their contents recorded separately from unit level materials. Methods and procedures used in excavation and analysis of features and their contents are described in the projects's research design (Campbell et al. 1984).

Four cultural features were recorded at 45-DO-204: a firepit, a living surface, an earth oven and associated pile of fire-modified rocks. Found in the upper three analytic zones at the site, they contained the highest densities of artifacts within the cultural deposit. All three have good radiocarbon dates and evidence human activity over at least 4500 years. Contents and dimensions are tabulated in Table 6-1.

FEATURE 1

Feature 1 is a shallow, unlined firepit uncovered in the southwest corner of excavation unit 2N42W, in unit level 80 cm (b.u.d.), Zone 3. Approximately 40 cm in diameter, the pit had been dug about 15 cm into the sand (Figure 6-1). The dark, charcoal-stained fill contained a single utilized flake, and many charred pine cone fragments. No other artifacts were found in direct association. A radiocarbon date of 4590±143 B.P. was obtained from charcoal fragments recovered from the fill.

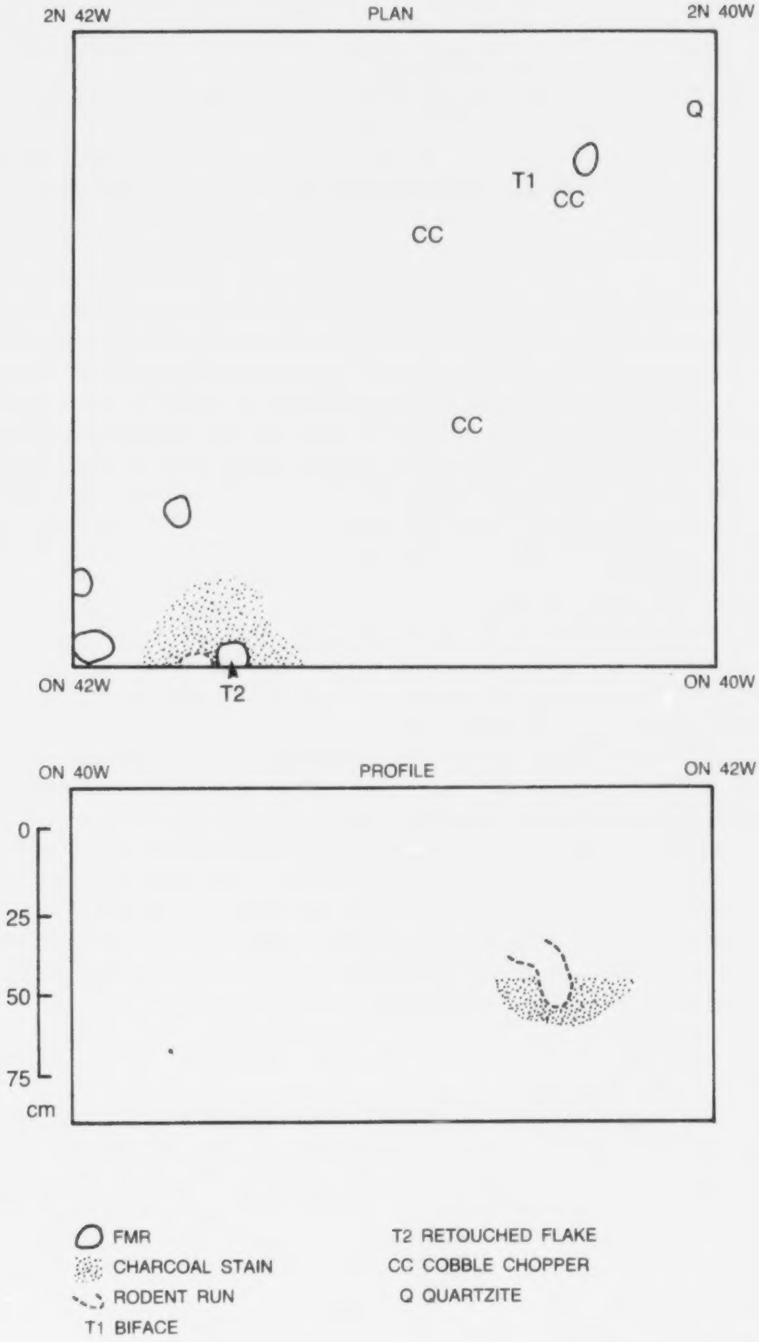
2N 42W
PLAN
2N 40W
Q
T1
CC
CC
CC
0N 42W
T2
0N 40W
0N 40W
PROFILE
0N 42W
0
25
50
75
cm
FMR
CHARCOAL STAIN
RODENT RUN
T1 BIFACE
T2 RETOUCHED FLAKE
CC COBBLE CHOPPER
Q QUARTZITE

Figure 6-1. Plan and profile views of Feature 1, 45-DO-204.

Table 6-1. Contents and dimensions of features, by zone, 45-DO-2

Feature[1]	Dimensions	Debitage	Bone		FMR		Est. Volume
			#	gms	#	gms	
Zone 1							
FMR Pile (311, Feature 4)	1 X 1 X .20m	2	–	–	77	44,910	.167m^2
Earth Oven (307, Feature 3)	1.5 X 1 X .20m	1	–	–	24	7,664	.10m^2
Zone 2							
Occupation Surface (209, Feature 2)	2 X 2 X .30m	103	330	52	4	370	.80m^2
Zone 3							
Firepit (107, Feature 1)	.40 X .15m	–	–	–	–	–	.10m^2

[1] The three digit code preceding feature number represents the feature classification to be employed in the final comparative report: first digit represents the cultural phase designation, the last two digits are cultural feature type (e.g., 107= Kartar Phase exterior firepit).

FEATURE 2

This is a stratum of darkly stained sand, charcoal, fire-modified cobbles, and charred and broken bone found in excavation unit 2N50W, Zone 2 (Plate 6-1, Figure 6-2). First exposed as a dark, circular stain, it eventually was traced over most of the 2 x 2-m square. Associated cultural material was found throughout unit levels 50-80 cm b.u.d., with the highest densities occurring in the two northern quads. The area of stain and artifacts occur as three separate, loosely associated patterns: a cluster of fire-modified cobbles and charred bone in the northwestern corner of unit 2N50W at levels 60-70 cm b.u.d.; a thick concentration of charcoal and cobbles in the southwestern corner of unit 2N49W at levels 60-70 cm b.u.d.; and the darkly stained sand in units 1N50W and 1N49W at levels 40-60 cm b.u.d., which held less dense concentrations of charcoal flecks and charred bone fragments than the other two areas.

We interpret as Feature 2 a living surface, comprising two areas where food was cooked, and another where game was butchered and food eaten. This third area is not shown in Figure 6-2, the plan map and profile of Feature 2, because it was not mapped in the field. The fire-modified rock occurs slightly below the more generalized stain because, we suspect, two shallow pits were dug below the occupation surface. These surmised cooking pits perhaps escaped the notice of the excavators because their soft sand margins were blurred. A radiocarbon date of 2812±344 B.P. was obtained from charcoal fragments in the general fill.

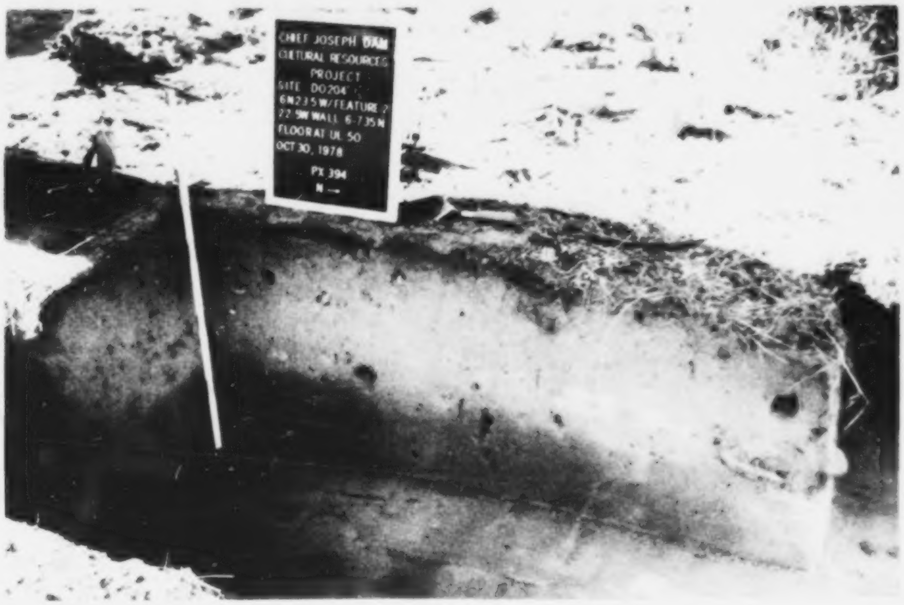

Plate 6-1. Profile showing upper sand strata with Feature 2, 45-DO-204.

FEATURES 3 AND 4

Feature 3 consists of a relatively shallow, dense concentration of charcoal-stained cobbles, charcoal-stained sand, and carbonized fragments of wood, found in excavation units 6.35N22.75W (1977 testing) and 6N23.5W (1978 salvage), Zone 1 (Figure 6-3). It was first observed as material eroding from the steep cutbank at the northern margin of the site; much of the original feature may have been destroyed prior to excavation. We estimate it was originally about 1.5-2 x 1 m, with a depth of at least 15-20 cm. Excavators recovered over 40 kg of fire-modified and charcoal-stained cobbles, most of which were from about 30 cm b.u.d. Beneath the greatest concentration of cobbles, in the approximate center of the pit, was a thick layer of darkly stained sand with fragments of charred wood. Bright orange, oxidized sand marked the bottom of the pit. A single non-utilized flake was found within this feature. Two radiocarbon samples were taken from the charred wood fragments, and yielded dates of 592±71 B.P. and 655±67 B.P.

Feature 4 is a dense concentration of fire-modified cobbles in the southwest corner of excavation unit 6N23.5W, Zone 1. First exposed at 2.5 cm b.u.d., it was found to extend down another 21.5 cm. It lies slightly above Feature 3 except to the southwest where it adjoins that feature. No charcoal fragments, charcoal stain, or associated artifacts were noted. The rocks were

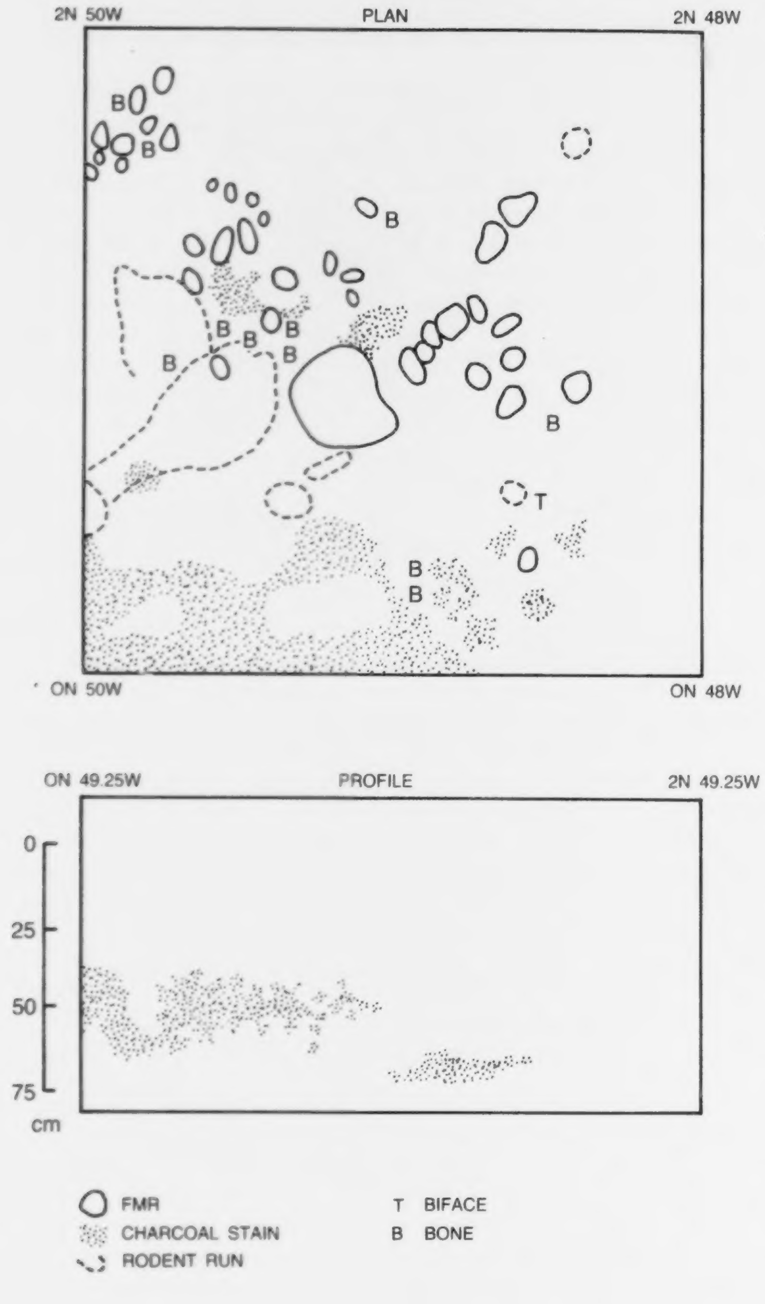
2N 50W
PLAN
2N 48W
ON 50W
ON 48W
B
T
ON 49.25W
PROFILE
2N 49.25W
0
25
50
75
cm
FMR
CHARCOAL STAIN
RODENT RUN
T BIFACE
B BONE

Figure 6-2. Plan and profile views of Feature 2, 45-DO-204.

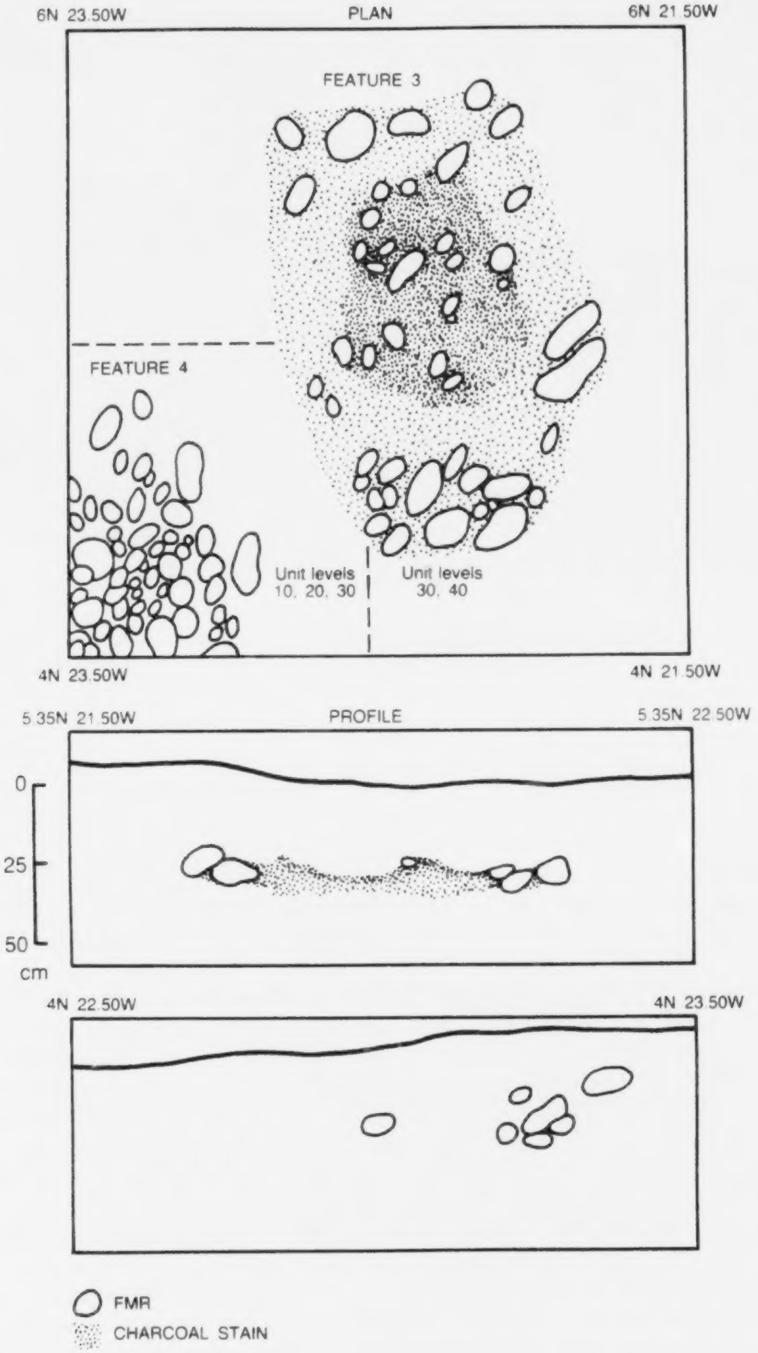
6N 23.50W
PLAN
6N 21.50W
FEATURE 3
FEATURE 4
Unit levels
10, 20, 30
Unit levels
30, 40
4N 23.50W
4N 21.50W
5.35N 21.50W
PROFILE
5.35N 22.50W
0
25
50
cm
4N 22.50W
4N 23.50W
FMR
CHARCOAL STAIN

Figure 6-3. Plan and profile views of Features 3 and 4, 45-DO-204.

arranged in a heap, with smaller stones at the top and larger cobbles at the bottom.

The proximity of Features 3 and 4 suggests that they are related. Feature 3, with a defined pit, thick charcoal, oxidized sand, and dense charcoal stain, is certainly evidence of a prepared cooking pit. Feature 4, on the other hand, is simply a pile of charred and cracked rocks, perhaps taken from the Feature 3 pit. Descriptions of prehistoric aboriginal earth ovens by Collier et al. (1942) and Chance and Chance (1982) strengthen this interpretation. The aboriginal peoples constructed such ovens by excavating a deep hole, and then filling it with firewood. They placed cobbles on top of the wood, and then lit the tinder. When the fire burned out, it left a layer of hot stones and coals. They laid green plants over the coals and rocks; placed their raw food above that; and then covered it with a second plant layer. Finally, they filled the pit with earth and lit a fire over it (cf., Ray 1932:106; Spier 1938:27). Such an activity might well explain the association observed in Features 3 and 4. Feature 4 may be cobbles removed from an oven after the cooking of food, while Feature 3 represents the basal portion of an earth oven, partially excavated to remove cooked food or in preparation for refiring.

ARTIFACT DISTRIBUTIONS

Patterns in the distribution of artifacts throughout cultural deposits at the site are a correlate to the distribution of defined cultural features. Together, they offer insight into the use of the site surface.

Four maps (Figures 6-4 through 6-7) show the distribution of lithics, FMR, bone, and shell by zone. These variables have distinctly clustered distributions in each zone. The denser concentrations of artifacts generally the northernmost part of the site, particularly excavation units 10N24W, 2N50W, and 2N42W, all of which contain defined cultural features. Other units with high artifact counts are generally those in close proximity to these units (e.g., 10N14W, 8N22W, 2S38W, 2S34W, and 0S40W). There are some clusters away from these units, however, including units 2N30W, 2S4W, 4S12W, 4S20E, and 14S4E. Zone 1 shows the most variable distribution, with lithic debitage and tool concentrations in units in the northeastern and southeastern parts of the site.

Lithic debitage, along with the bone, shell, fire-modified rock, and worn and manufactured artifacts, occur most frequently along the northwest margin of the site, although lithic debitage is more widely distributed than the other categories. Within this overall pattern, however, an interesting trend is evident: fire-modified rock occurs with lithic artifacts rather than bone or charcoal. This may mean that evidence of fire and cooking is not well preserved in the site record and that many of the lithic associations were the consequence of everyday living activities rather than special purpose activities. Features 2, 3, and 4 account for a large number of fire-modified rocks in close association with definable activities (units 8N24W and 2N50W). Though fire-modified rock, lithic debitage, and tools occur in high densities away from these features, bone, charcoal, and charcoal-stained sand are

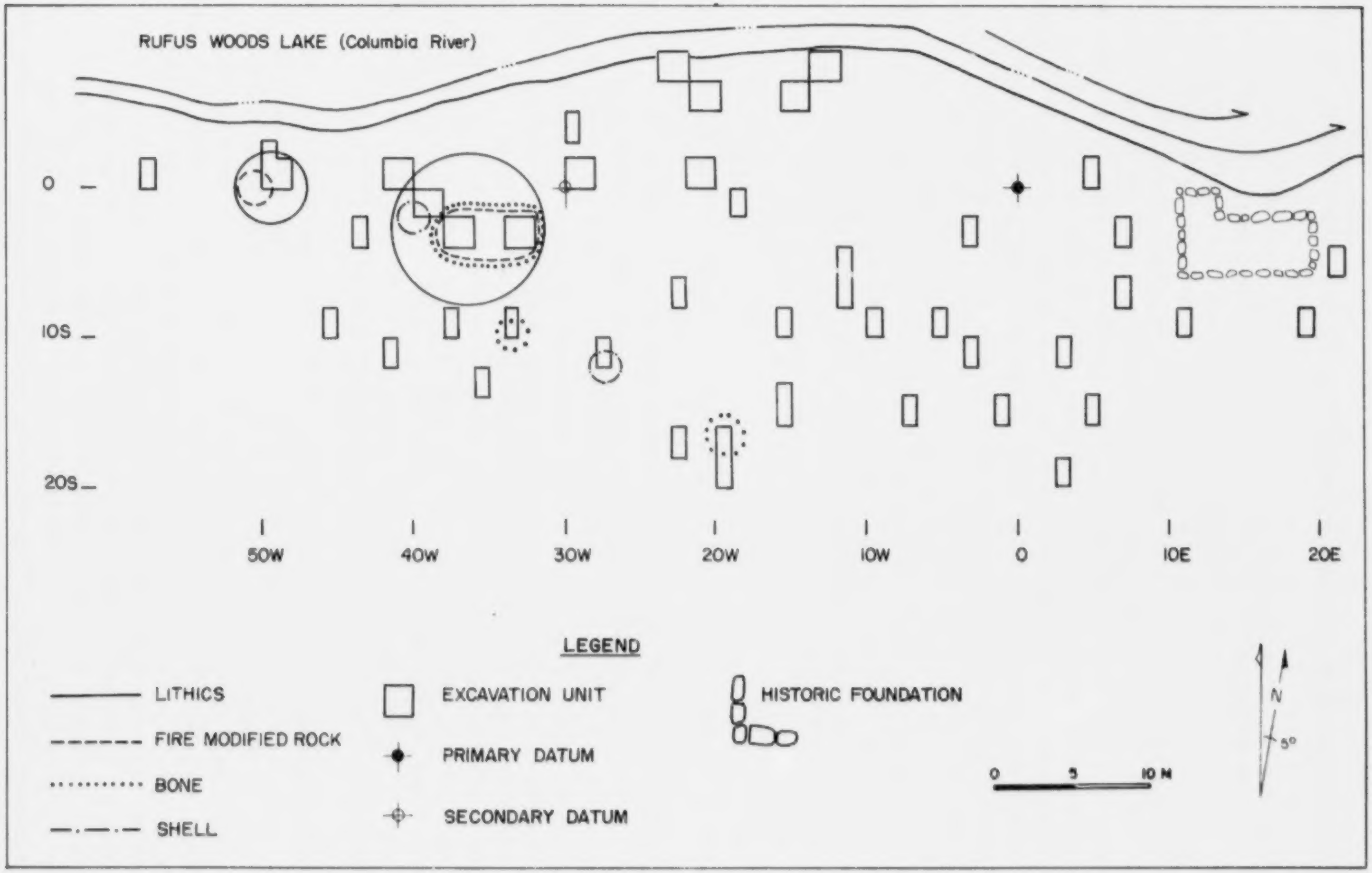
RUFUS WOODS LAKE (Columbia River)
0
10S
20S
50W
40W
30W
20W
10W
0
10E
20E
LEGEND
LITHICS
FIRE MODIFIED ROCK
BONE
SHELL
EXCAVATION UNIT
PRIMARY DATUM
SECONDARY DATUM
HISTORIC FOUNDATION
0
5
10 M
N
5°

Figure 6-4. Concentrations of cultural materials, Zone 4, 45-DO-204.

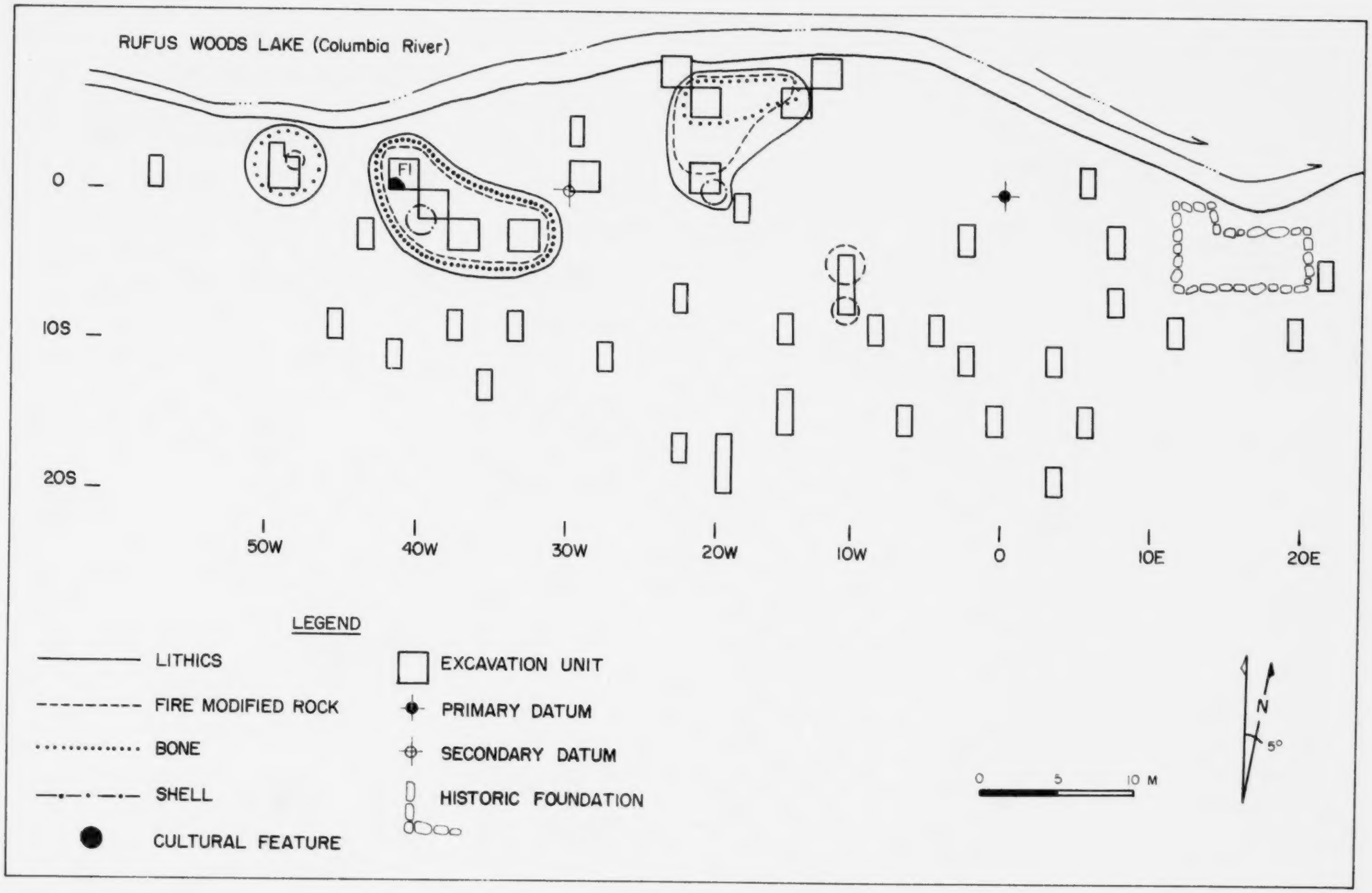
RUFUS WOODS LAKE (Columbia River)
F1
0
10S
20S
50W
40W
30W
20W
10W
0
10E
20E
LEGEND
LITHICS
FIRE MODIFIED ROCK
BONE
SHELL
CULTURAL FEATURE
EXCAVATION UNIT
PRIMARY DATUM
SECONDARY DATUM
HISTORIC FOUNDATION
0
5
10 M
N
5°

Figure 6-5. Concentrations of cultural materials, Zone 3, 45-DO-204.

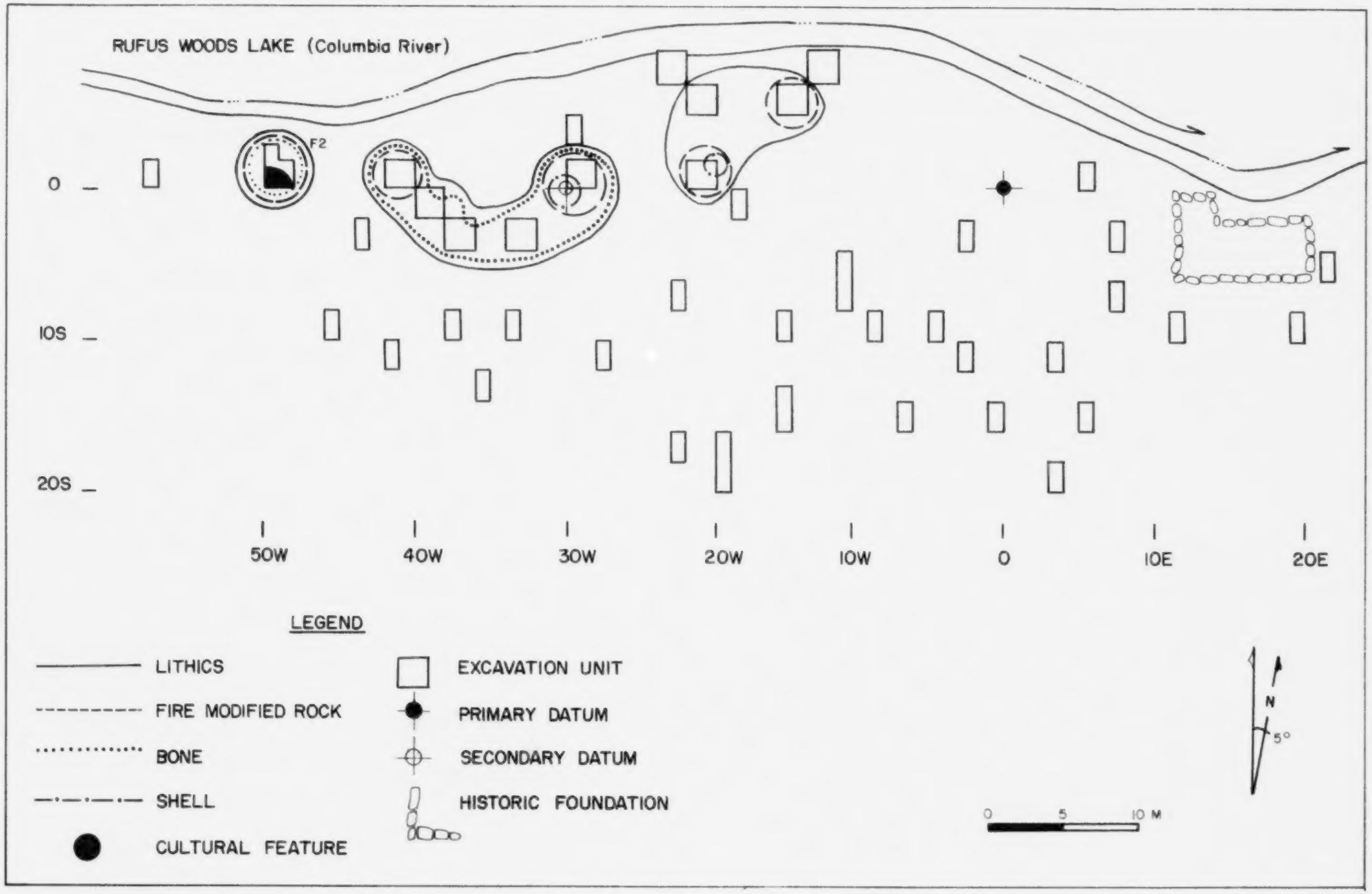
RUFUS WOODS LAKE (Columbia River)
F2
0
10S
20S
50W
40W
30W
20W
10W
0
10E
20E
LEGEND
LITHICS
FIRE MODIFIED ROCK
BONE
SHELL
CULTURAL FEATURE
EXCAVATION UNIT
PRIMARY DATUM
SECONDARY DATUM
HISTORIC FOUNDATION
N
5°
0
5
10 M

Figure 6-6. Concentrations of cultural materials, Zone 2, 45-DO-204.

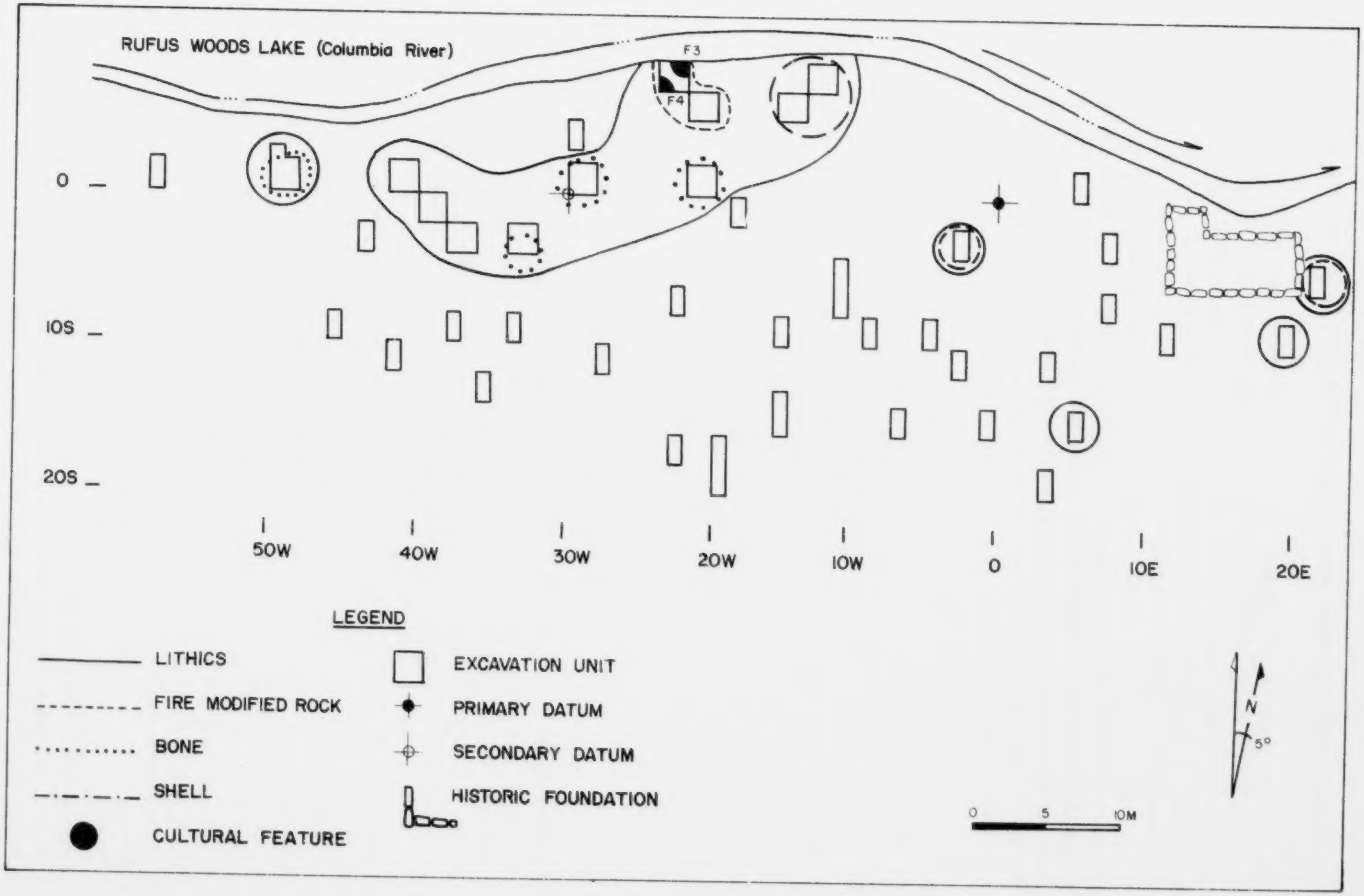
RUFUS WOODS LAKE (Columbia River)
F3
F4
0
10S
20S
50W
40W
30W
20W
10W
0
10E
20E
LEGEND
LITHICS
FIRE MODIFIED ROCK
BONE
SHELL
CULTURAL FEATURE
EXCAVATION UNIT
PRIMARY DATUM
SECONDARY DATUM
HISTORIC FOUNDATION
N
5°
0
5
10M

Figure 6-7. Concentrations of cultural materials, Zone 1, 45-DO-204.

absent, probably showing that excavation failed to reveal the focus of these activities.

The site occupants, it seems, tended to prefer that part of the site nearest the river: activities occurred in those areas irrespective of zone. The proximity of the river and the soft, sandy overbank sediments probably influenced the occupants' pattern of site use. Conversely, a lack of loose, sandy sediments may have resulted in the more random pattern of site use evident in Zone 1. In any event, the most plentiful evidence of prehistoric occupation occurs along the cutbank. This fact, coupled with the observation that cultural materials were eroding from the cutbank, suggests that much of the site was destroyed by the rising waters of the Columbia River.

7. SYNTHESIS

Site 45-DO-204, on the south bank of the Columbia River just upstream from Parsons Rapids, was used frequently as a summer campsite for at least 4,500 years. Prehistoric task groups were drawn to the flat sandy surface situated less than 26 m above the pre-1950's level of the river. The camp would have afforded easy access to water, fish, large and small game, and a variety of plant resources.

Faunal remains, cultural features, and artifact assemblages all indicate the site was used as a spring-summer hunting and gathering base camp in all three cultural phases defined for the Rufus Woods Lake project area. There game was butchered and eaten, and animal by-products were processed. The site occupants also utilized plant products, primarily seeds, but this use seems clearly ancillary to the hunt-related activities. Most occupations probably represent visits of a few days or less by small family groups or hunting parties of related males. However, a single living surface and a reused earth oven suggest at least two visits of longer or more intensive duration during the latter part of the Hudnut Phase (2800 B.P.) and the Coyote Creek Phase (ca. 600 B.P.).

ZONE 4 (Kartar Phase, pre-4500 B.P.)

The sparsest cultural assemblage at the site, Zone 4 lacked both cultural features and botanical remains, and held very low frequencies of artifacts. It represents human activity subsequent to the eruption of Mt. Mazama (ca. 6800 B.P.), and during periods of river overbank deposition atop the basal gravel terrace, ash and sand. Debitage, the most abundant artifact class in this zone, seldom exceeds a density of two objects per 10 cm unit (2 x 2-m square). Unit 2S37W (160 cm b.u.d.) had the highest density with ten objects. Although scarce, shell and fire-modified rock do occur. Bone is the most common type of material recovered. Identifiable bone fragments were from voles, mice, and gophers, species that now inhabit the site. None showed any marks of butchering or cooking. Only two formed tools were found, a triangular projectile point preform and a chalcedony blade. The blade was recovered from the oldest stratigraphic contect of any lithic at the site; associated with it were a small, unidentified bone fragment and a single piece of shell (Margaritifera sp.). The projectile point preform was found at the upper limit of Zone 4, with 55 fragments of rodent bone, nine utilized flakes, and three indeterminate objects.

Zone 4 represents human use of the site probably more than 4,500 years ago. Given the small assemblage and the absence of features, we can make few statements about activities at the site. The presence of lithic debitage shows that lithic reduction took place at the site and fire-modified rock indicates the use of camping or cooking fires.

ZONE 3 (Kartar Phase, ca. 4500-4000 B.P.)

Zone 3, the second largest cultural assemblage (N=2,741, 32%), includes a variety of technological and functional forms. The visiting prehistoric groups utilized the rapidly accreting alluvial bar. The sandy overbank deposits resulted from increasing river level fluctuation correlating with a period of increased precipitation from ca. 5000-1500 B.P. (Hansen 1947; Fryxell 1973). In comparison with Zone 4, this zone has high frequencies of noncryptocrystalline and cryptocrystalline flakes, and markedly higher counts of objects with cortex, indicating primary reduction of both materials. Choppers, hammerstones, scrapers, drills, and gravers are also more frequent in Zone 3. Coupled with significant increases in frequency of wear areas this suggests more intensive activity during this period. The higher frequency of deer and deer-sized bone fragments associated with discrete patterns in artifact distribution (Figure 3-6) indicates longer-term occupations in Zone 3. An isolated cache of bitterbrush seeds suggests at least one summer occupation. The single cultural feature is a small firepit radiocarbon dated at 4590±143 B.P. Charred and carbonized fill contained pine cone fragments, pine seeds, and bitterbrush seeds, which again evidence summer occupation. Debitage and object types document all stages of lithic manufacture. The single core recovered from the site was found in this zone.

Concentrations of fire-modified rock, bone, and lithics define several activity areas in the northwestern part of the site area. These densities increase toward the river cutbank. The most well-defined such area includes the firepit mentioned above and extends over three contiguous excavation units (2N42W, 0S40W, 2S38W) and a nearby unit (2S34W). This 16 m^2 area yielded over 57% of the tools recovered from Zone 3, including bifaces (N=2), a projectile point base, a scraper, a tabular knife, choppers (N=5), microblades (N=3), a shaft abrader, resharpened flakes (N=4), bifacially retouched flakes (N=4), unifacially retouched flakes (N=8), and utilized flakes (N=30). Associated faunal remains consist of painted turtle, rabbit, deer and deer-sized bone fragments. The cache of bitterbrush seeds in unit 1S44W, may be associated with this area. Evidence points to a summer occupation, with butchering the probable focus of activity. Given the high density of debitage and numerous resharpened and retouched flakes, and the shaft abrader, we may infer a stay of some length--perhaps a hunting camp where tools were repaired and manufactured, and game was butchered.

Similar tool types are scattered elsewhere over the site area in this zone, but patterns are diffuse and do not approach the tight association described for the activity area above.

ZONE 2 (Hudnut Phase, ca. 3000-2000 B.P.)

Zone 2 contains the largest cultural assemblage at the site (N=3,533, 42%), with the same range of technological and functional forms observed in Zone 3. Human activity was still taking place on sandy overbank sediments laid down by the fluctuating river. Upper levels of sand were also being deposited by increased slope wash stream action, yet more evidence of greater effective precipitation during this time. Primary reduction of both cryptocrystalline and noncryptocrystalline stones occurred. The tool collection resembles that found in Zone 3, with only some slight variations. For instance, wear on small linear flakes occurs only in this zone, and wear area:object ratios are higher for unifacially retouched flakes, tabular knives, and scrapers. Hinged chipping wear is more frequent, particularly on straight edges. This may either indicate more intensive butchering activity, or a different range of associated butchering-processing activities. The presence of a well-defined living surface of charcoal-stained sand with a high density of deer-sized bone fragments and associated butchering tools would suggest longer stays by larger hunting parties. Recovery of a pestle may indicate the presence of women, and so this occupation may represent a household, or group of households, engaged in plant gathering/processing as well as hunting. Feature 2 in unit 2N50W (Figure 3-7), and radiocarbon dated at 2812±344 B.P., may correlate with higher fire-modified rock, bone, tool and debitage densities observed in units immediately to the east (2N42W, 0S40W, 2S38W, 2S34W, and 2N30W). This 25 m^2 area produced over 58% of the tools recovered from Zone 2, including bifaces (N=2), a drill, a graver, scrapers (N=2), a pestle, tabular knives (N=4), microblades (N=2), a resharpened flake, bifacially retouched flakes (N=7), unifacially retouched flakes (N=6), and utilized flakes (N=23). Associated faunal remains consist of gopher, marmot, deer and deer-sized bone fragments. A high concentration of plant materials was associated with this feature--conifer material, bitterbrush hardwood and seeds, traces of grass, and a few pieces of parenchymoid tissue. The seasonal indicators--marmot bones and charred and uncharred bitterbrush seeds--place occupation in the summer months. The character of the tool assemblage and the deer-sized bone fragments, charred and marked by butchering, document hunting and related processing and manufacturing activities. Some working of hides and bone also occurred, as indicated by the scrapers, the drill, and the graver. The thick, heavily stained surface and the relative density of debris suggest that occupation was prolonged, perhaps involving several nuclear families, or that visits were frequent over a single summer or several years.

Scattered over the site surface in this zone were a comparable range of tools and debris. These suggest similar activities, perhaps related to this occupation or the consequence of stays of shorter tenure by smaller groups.

ZONE 1 (Coyote Creek Phase, ca. 6000 B.P.)

Though excavators recovered a smaller cultural assemblage from this zone than from either Zone 2 or Zone 3, artifact counts still comprised almost 16% of the total. At this time, river overbank deposition had ceased, indicating that the river level had fallen well below the 305 m terrace on which the site lies. Sediments were now being deposited by slope wash, stream action, and aeolian processess. A change of intensity in site use is reflected in smaller numbers of tools, and a lack of choppers, drills, gravers, scrapers, and bifacially retouched flakes. Other common forms--bifaces, resharpened flakes, tabular knives, unifacially retouched flakes, and utilized flakes--although present in lower frequencies, indicate a similar range of activities to those observed in earlier zones. Indeed, hammerstones, absent in Zone 2, reappear in Zone 1. The most significant indicator of a shift in site use is the earth oven, which was reused at least once, and radiocarbon dated at 592±71 B.P. and 655±67 B.P.

First identified eroding from the river cutbank, this feature was defined in unit 10N24W. It lies within a large, somewhat diffuse lithic scatter which covers much of the northern margin of the site (Figure 3-8); quite likely, the use of the feature was associated with this area. Excavators found no tools directly associated with the oven, but from nearby units to the south (4N22W) and east (6N14W, 4N16W) they recovered 25% of the tools collected in Zone 1, including a projectile point tip, a chopper, a tabular knife, hammerstones (N=2), bifacially retouched flakes (N=2), and utilized flakes (N=7). These units also yielded an assemblage of deer and deer-sized bone fragments much like those identified for areas of Zone 2 and Zone 3. The feature itself held a wide variety of stratified vegetable matter. The stratification indicates the oven was filled with several layers--at the bottom heated cobbles on which the leaf-wrapped food was placed, followed by a layer of grasses and other leafy materials, and then pine wood, which was fired. This resembles historically described ovens (cf. Chance and Chance 1982; Collier et al. 1942; Ray 1932). A pile of charred and fire-blackened cobbles nearby suggests at least one reuse of the oven. The charred bitterbrush seeds indicate a firing in summer.

In this area, then, plant parts were processed and deer butchered. The artifact assemblage resembles those identified in lower levels, again associated with deer and deer-sized bone fragments, as well as smaller game species. Other areas of sparser artifact concentration reveal a similar range of tools and debitage indicative of hunting, butchering, and tool manufacture and repair. These areas could be associated with use of the earth oven but this is uncertain. They bear out the use of the site area in Zone 1 as a hunting and gathering base camp.

SUMMARY

45-DO-204 was used as a hunting and gathering base camp over at least 4,500 years. During that time the economic strategy was consistent; recovered tool kits remain relatively uniform in character and task groups were apparently drawn to the same location again and again. Clearly, the site offered its occupants access to both game and plant resources. Near water, its ground soft and sandy, it was an often used spot.

Analyses of the features and artifact assemblages do indicate some variation in the nature and intensity of activities at the site, and changes in group composition and in the duration of their tenure. However, we must temper our inferences with the knowledge that we lack fully exposed activity areas with demonstrated physical connections and spatially defined artifact clusters. Still, our several linked lines of evidence--cultural matrix composition, artifact distribution, and faunal and botanical materials--permit us to advance some statements about changes in the use of the site.

In Zone 3, which corresponds to the defined Kartar Phase, the site occupants--small task groups--devoted their energies to hunting and the processing of hunt-related by-products. They probably visited the site in summer, stayed a short time, to return again other summers. In Zone 2 (Hudnut Phase) both the living surface and the artifact distributions suggest that similar economic activities were carried out, again in the summer. Now, however, the groups were probably larger, visited more frequently, and stayed longer. There follows a hiatus of 1,000-1,500 years before the occupation of Zone 1 occurs (Coyote Creek Phase). Again, the economic focus, the associated artifact assemblage, and season are similar to those of the previous occupations. The task groups are smaller apparently and confine themselves to very short, recurrent visits. In this zone, there is solid evidence of plant exploitation, preserved in the botanical materials excavated from an earth-oven.

Thus, 45-DO-204 served as a summer camp site where the primary economic focus was the hunting of deer, although plants were also gathered and consumed. While we note some variations in the nature of the occupations at the site, what is most marked is their continuity. By itself, 45-DO-204 does not constitute proof of a stable adaptive strategy. But a similar pattern of site use is found up and down Rufus Woods Lake from about 6000 B.P. to historic times. Site use may have shifted from a seasonal camp to a living site and back to a seasonal camp or from a large living site to series of seasonal camps as at 45-DO-211 and 45-DO-242/243 (Lohse 1983b,c). Housepits are present at 45-OK-11 (Lohse 1984f) in the earliest period, at 45-OK-258 (Jaehnig 1983a) and 45-OK-250/4 (Miss 1984c) in the range 4000-2000 B.P., and at 45-OK-2/2A (Campbell 1984b) in the latest period from about 2000-200 B.P. These sites also contain earlier and later seasonal camps, much like those observed at other sites in the project area and representative of the 7,000 year span of human occupation along the river. The existence of a village-based pattern with outlying hunting and gathering camps at so early a date, and continuing on up to historic times, suggests a consistent adaptive strategy oriented toward a predictable environment.

This is somewhat at odds with postulates of significant shifts in adaptive stragegy about 4,000 to 3,000 years ago (Nelson 1969, 1973; Leonhardy and Rice 1970) which supposedly led to the establishment of a village pattern very like that described ethnographically, one perhaps related to the spread of Salishan speakers out onto the Columbia Plateau 4,000-3,000 years ago (cf. Elmendorf 1965). We do not take issue with the idea of a Salishan migration except that it seems clear that change cannot be the consequence of one adaptive strategy replacing another, at least not in the Rufus Woods Lake Reservoir, where socioeconomic patterns seem very consistent over time.

REFERENCES

Ahler, S.A.

1970 Projectile point form and function at Rodgers Shelter, Missouri. **Missouri Archaeological Society, Research Series** 8.

Benfer, R.A.

1967 A design for the study of archaeological characteristics. **American Anthropologist** 69:719-730.

Butler, B.R.

1961 The Old Cordilleran culture in the Pacific Northwest. **Idaho State College Museum, Occasional Papers** 5.

1962 Contributions to the prehistory of the Columbia Plateau. **Occasional Papers of the Idaho State College Museum** 9.

Campbell, S.K.

1984a **Archaeological investigations at nonhabitation sites, Chief Joseph Dam Project, Washington.** Office of Public Archaeology, University of Washington, Seattle.

1984b **Archaeological Investigations at Sites 45-OK-2 and 45-OK-2A, Chief Joseph Dam Project, Washington.** Office of Public Archaeology, University of Washington, SEattle.

Campbell, S.K. (editor)

1984c **Report of burial relocation projects, Chief Joseph Dam Project, Washington.** Office of Public Archaeology, University of Washington, Seattle.

1984d **Research Design for the Chief Joseph Dam Project, Washington.** Office of Public Archaeology, University of Washington, Seattle.

Chamberlain, A.B.

1892 Report on the Kootenay Indians of Southeastern British Columbia. **Eighth Report on the Northwestern Tribes of Canada.** British Association for the Advancement of Science, Edinburgh.

Chance, D.H., and J.V. Chance

1982 Kettle Falls: 1971/1974. **University of Idaho, Anthropological Research Manuscripts Series** 69.

Collier, D., A.E. Hudson, and A. Ford
1942 Archaeology of the upper Columbia region. **University of Washington, Publications in Anthropology** 9(1).

Couch, L.K.
1927 Migration of the Washington black-tailed jackrabbit. **Journal of Mammalogy** 8:113-114.

Crabtree, D.E.
1967a Notes on experiments in flintknapping: 4. tools used for making flaked stone artifacts. **Tebiwa** 10:60-73.

1967b The flintknapper's raw materials. **Tebiwa** 10(1):8-24

1972 An introduction to flintworking. **Idaho State University Museum, Occasional Papers** 28.

1973 The obtuse angle as a functional edge. **Tebiwa** 16:46-53.

Cressman, L.S., D.L. Cole, W.A. Davis, T.M. Newman, and D.J. Scheans
1960 Cultural sequence at The Dalles, Oregon: a contribution to Pacific Northwest prehistory. **American Philosophical Society, Transactions** 50(10).

Dalquest, W.W.
1948 Mammals of Washington. **University of Kansas Museum of Natural History, Publications** 2.

Damon, P.E., C.W. Ferguson, A. Long, and E.I. Wallick
1974 Dendrochronological calibration of the radiocarbon time scale. **American Antiquity** 39:350-366.

Daubenmire, R.F.
1970 Steppe vegetation of Washington. **Washington State University, Washington Agricultural Experiment Station, Technical Bulletin** 62.

Davis, P. T.
1984 Report on five tephra samples from Chief Joseph Dam Cultural Resources Project. In, **Summary results, Chief Joseph Dam Cultural Resources Project**, edited by M.E.W. Jaehnig and S.K. Campbell. Office of Public Archaeology, University of Washington, Seattle.

Dennell, R.W.
1976 The economic importance of plant resources represented on archaeological sites. **Journal of Archaeological Science** 3:229-247.

Dimbleby, G.
1967 **Plants and archaeology**. Humanities Press, New York.

Dunnell, R.C.
1971 **Systematics in prehistory.** Free Press, New York.

1979 Archaeological potential of anthropological and scientific models of function. In **Essays in honor of Irving B. Rouse,** edited by R.C. Dunnell and E.S. Hall, Jr., pp. 41-73. Mouton, The Hague.

Elmendorf, W.W.
1965 Linguistic and geographic relations in the northern Plateau area. **Southwestern Journal of Anthropology,** 21(1):63-78.

Esau, K.
1965 **Plant anatomy** (second ed.), John Wiley, New York.

Flenniken, J., and E. Garrison
1975 Thermally altered novaculite and stone tool manufacturing techniques. **Journal of Field Archaeology** 2:125-131.

Ford, R.I.
1979 Paleoethnobotany in American archaeology. In **Advances in archaeological method and theory,** edited by M.B. Schiffer, pp. 285-336. Academic Press, New York.

Franklin, J.F., and C.T. Dyrness
1973 Natural vegetation of Oregon and Washington. **U.S. Department of Agriculture, Forest Service, General Technical Report** PNW-8.

Frison, G.C.
1968 A functional analysis of certain chipped stone tools. **American Antiquity** 33:149-155.

Fryxell, R.
1973 Salvage of geochronological information in the Wells Reservoir Area, Washington (1964-1972). A report to the National Park Servvice, Washingtion State University, Laboratory of Anthropology.

Greengo, R.E.
1982 Studies in prehistory, Priest Rapids and Wanapum Reservoir areas, Columbia River, Washington. Report to U.S. Department of Interior, National Park Service, San Francisco. University of Washington, Department of Anthropology.

Gunn, J. and E.R. Prewitt
1975 Automatic classification: projectile points from west Texas. **Plains Anthropologist** 20:139-149.

Gustafson, C.E.
1972 **Vertebrate faunal remains from the Marmes rockshelter and related archaeolgical sites in the Columbia Basin.** Ph.D. dissertation, Washington State University. University Microfilms, Ann Arbor.

Hansen, H.P.
1947 Post-glacial forest succession, climate and chronology in the Pacific Northwest. **American Philosophical Society, Transactions,** 31(1).
Hayden, B. (editor)
1979 **Lithic use-wear analysis.** Academic Press, New York.

Hibbert, D.M.
1980 Quaternary geology and the history of the landscape along the Columbia between Chief Joseph and Grand Coulee Dams. Ms. on file, U.S. Army Corps of Engineers, Seattle District.

Holmer, R.N.
1978 **A mathematical typology for archaic projectile points of the Eastern Great Basin.** Unpublished Ph.D. dissertation, Department of Anthropology, University of Utah.

Jaehnig, M.E.W.
1981 **Field investigations at the Chief Joseph Project: aspects of organization and some preliminary results.** Paper presented at the 34th Annual Northwest Anthropological Conference, Portland.

1983a Archaeological investigations at Site 45-OK-258, Chief Joseph Dam Reservoir, Washington. Ms. on file, U.S. Army Corps of Engineers, Seattle District.

1983a **Chief Joseph Dam Cultural Resources Project: preliminary report of field investigations, 1978-1980.** Office of Public Archaeology, University of Washington, Seattle.

1984a **Archaeological investigations at Site 45-DO-273, Chief Joseph Dam Project.** Office of Public Archaeology, University of Washington, Seattle.

1984b **Archaeological investigations at Site 45-OK-18, Chief Joseph Dam Project, Washington.** Office of Public Archaeology, University of Washington, Seattle.

Jaehnig, M.E.W. and S.K. Campbell
1984 **Summary of results, Chief Joseph Dam Cultural Resources Project.** Office of Public Archaeology, University of Washington, Seattle.

Jermann, J.V., W.S. Dancey, R.C. Dunnell, and B. Thomas
1978 Chief Joseph Dam cultural resources management plan. Ms. on file, U.S. Army Corps of Engineers, Seattle District.

Johnson, R.J.
1978 **Multivariate statistical analysis in geography.** London: Longwan Group Limited.

Keeley, L.
1974 Technique and methodology in microwear studies: a critical review. **World Archaeology** 5:323-336.

Keeley, L.
1978 Microwear polishes on flint: some experimental results. In Lithics and subsistence: the analysis of stone tool use in prehistoric economies, edited by D. Davis. **Vanderbilt University Publications in Anthropology** 20.

Klecka, W.R.
1980 **Discriminant Analysis.** Sage Publications, Inc., Beverly Hills.

Leonhardy, F.C.
1970 An evaluation of the archaeological resources in the Rufus Woods area behind Chief Joseph Dam, Columbia River, Washington. Report prepared for the National Park Service, San Francisco. Washington State University, Laboratory of Anthropology.

Leonhardy, F.C. and G.R. Muto
1972 **The Levallois technique on the Lower Snake River.** Paper presented at the 1972 Northwest Anthropological Conference, Portland.

Leonhardy, F.C., and D.G. Rice
1970 A proposed culture typology for the lower Snake River region, southeastern Washington. **Northwest Anthropological Research Notes** 4(1):1-29.

Leonhardy, F.C., G. Schroedl, J.Bense, and S. Beckman
1971 Wexplsnime (45GA61): preliminary report. Report to the National Park Service. **Washington State University, Laboratory of Anthropology, Reports of Investigations** No. 49.

Lewis, W.H., and M.P.F. Elvin-Lewis
1977 **Medical botany.** John Wiley, New York.

Lohse , E.S.
1984a **Archaeological Investigations at Site 45-DO-204, Chief Joseph Dam Reservoir, Washington.** Office of Public Archaeology, University of Washington, Seattle.

1984b Archaeological Investigations at Site 45-DO-211, Chief Joseph Dam Reservoir, Washingtion. Ms. on file, U.S. Army Corps of Engineers, Seattle District.

1984c **Archaeological Investigations at Site 45-DO-242/243, Chief Joseph Dam Reservoir, Washington.** Office of Public Archaeology, University of Washington, Seattle.

1984d **Archaeological Investigations at Site 45-DO-282, Chief Joseph Dam Reservoir, Washington.** Office of Public Archaeology, University of Washington, Seattle.

1984e **Archaeological Investigations at Site 45-DO-326, Chief Joseph Dam Reservoir, Washington.** Office of Public Archaeology, University of Washington, Seattle.

1983f **Archaeological Investigations at Site 45-OK-11, Chief Joseph Dam Reservoir, Washington.** Office of Public Archaeology, University of Washington, SEattle.

1984g Rufus Woods Lake Projectile Point Chronology. In **Summary of results, Chief Joseph Cultural Resources Project**, edited by M.E.W. Jaehnig and S.K. Campbell. Office of Public Archaeology, University of Washington, Seattle.

Lyman, R.L.

1976 Exploratory archaeological research along Rufus Woods Lakes upper Columbia River region north-central Washington. Washington Archaeological Research Center, **Project Report** 29. Washington State University, Pullman.

Miss, C.J.

1984a **Archaeological Investigations at Site 45-DO-214, Chief Joseph Dam Reservoir, Washington.** Office of Public Archaeology, University of Washington, Seattle.

1984b **Archaeological Investigations at Site 45-DO-285, Chief Joseph Dam Reservoir, Washington.** Office of Public Archaeology, University of Washington, Seattle.

1984c **Archaeological Investigations at Site 45-OK-250/4, Chief Joseph Dam Reservoir, Washington.** Office of Public Archaeology, University of Washington, Seattle.

1984d **Archaeological Investigations at Site 45-OK-287/288, Chief Joseph Dam Reservoir, Washington.** Office of Public Archaeology, University of Washington, Seattle.

Munsell, D.A.

1968 The Ryegrass Coulee site. Unpublished M.A. thesis, University of Washington, Department of Anthropology.

Muto, G.R.

1971 **A technological analysis of the early stages in the manufacture of lithic artifacts.** Unpublished M.A. thesis, Department of Anthropology, Idaho State University.

1976 The Cascade technique: an examination of a Levallois-like reduction system in early Snake River prehistory. Unpublished Ph.D. dissertation, Department of Anthropology, Washington State University.

Nelson, C.M.

1969 The Sunset Creek site (45-KT-28) and its place in Plateau prehistory. **Washington State University, Laboratory of Anthropology, Reports of Investigations** 47.

1973 Prehistoric culture change in the Intermontane Plateau of western North America. In **The explanation of culture change,** edited by C. Renfrew, pp. 371-390. Duckworth, London.

Nie, N.H., C.H. Hull, J.G. Jenkins, K. Steinbrenner, and D.H. Bent

1975 **SPSS: statistical package for the social sciences** (second edition). Mcgraw-Hill, New York.

Odell, G.H.

1977 **The application of micro-wear analysis to the lithic component of an entire prehistoric settlement: methods, problems and functional reconstructions.** Unpublished Ph.D. dissertation, Department of Anthropology, Harvard University.

Piper, C.

1906 Flora of the state of Washington. In **Contributions to the U.S. National Herbarium** (Vol. II). U.S. Government Printing Office, Washington, D.C.

Ray, V.F.

1932 The Sanpoil and Nespelem: Salishan peoples of northeast Washington. **University of Washington, Publications in Anthropology** 5.

Renfrew, J.M.

1973 **Paleoethnobotany.** Columbia University Press, New York.

Rice, D.G.

1972 The Windust phase in lower Snake River prehistory. **Washington State University, Laboratory of Anthropology, Reports of Investigations** 50.

Sanger, D.
1968 Prepared core and blade traditions in the Pacific Northwest. **Arctic Anthropology** 5:92-120.

1970 Midlatitude core and blade traditions. **Arctic Anthropology** 7:106-114.

Semenov, S.A.
1964 **Prehistoric technology: an experimental study of the oldest tools and artifacts from traces of manufacture and wear** (translated by M.W. Thompson). Cory, Adams & Mackay, London.

Smith, L., and A. Goodyear
1976 The statistical discrimination of hard and soft percussors. Ms. in hands of authors.

Speth, J.
1972 Mechanical basis of percussion flaking. **American Antiquity** 37:34-60.

Spier, L. (editor)
1938 The Sinkaietk or Southern Okanogan of Washington. **George Banta, General Series in Anthropology** 6.

Stafford, B.D.
1979 **A technofunctional study of lithics from Payson, Arizona.** Unpublished Ph.D. dissertation, Department of Anthropology, Arizona State University.

Stafford, B.D., and C.R. Stafford
1979 **A comparison of macro- and microwear functional analyses of lithics.** Paper presented at the 44th Annual Meeting of the Society for American Archaeology, Vancouver, B.C.

Stebbins, R.C.
1966 **A field guide to western reptiles and amphibians.** Houghton Mifflin, Boston.

Swanson, E.H., Jr.
1962 The emergence of Plateau Culture. **Occasional Papers of the Idaho State College Museum** 8.

Swanson, E.H., Jr. (editor)
1975 **Lithic technology, making and using stone tools.** Mouton, The Hague.

Turner, N.J.
1979 Plants in British Columbia Indian technology. **British Columbia Provincial Museum, Handbook** 38.

Turner, N.J., R. Bouchard, and D.I.D. Kennedy
1980 Ethnobotany of the Okanagan-Colville Indians of British Columbia and Washington. **British Columbia Provincial Museum, Occasional Papers** 21.

U.S.D.A.
1974 Seeds of woody plants in the United States. **U.S. Department of Agriculture, Forest Service, Handbook** 450.

Wilmsen, E.N.
1968 Functional analysis of flaked stone artifacts. **American Antiquity** 33:156-161.

Wilmsen, E.N.
1970 Lithic analysis and cultural inference: a paleo-Indian case. **University of Arizona, Anthropological Papers** 16.

APPENDIX A:

RADIOCARBON DATE SAMPLES AND RESULTS OF SOIL ANALYSES

Table A-1. Radiocarbon date samples.

Lab Sample #[1]	Zone	DU	Stratum	Unit	Level	Feature #	Material/gms	Radiocarbon Age (years B.P.) T1/2=5730	Dendrocorrected[2] Age (Years B.P.)
TX-2896	2	IVb	450	2N50W	70B	2	Charcoal/1.2	2660±340	2812±344
	Sample from testing. Feature 2 = occupation surface. A flot from level 70A contained Douglas fir (*Pseudotsuga*), yellow pine, a *Chenopodium* sp. seed and a bitterbrush seed (*Purshia*) fragment, pine bark and pitch.								
TX-2897	1	V	200	5.35N from 21.5-22.75W	40	1	Charcoal/8.0	570±60	592±71
	Sample from testing. Feature 1 (testing) = earth oven. Sample taken from a portion of Feature 1 (testing) which extended into the cutbank.								
TX-4023	3	N/A	N/A	1N42W	80	1	Charred pine cone/5.3	4030±100	4590+143
	Feature 1 = firepit. Sample consists of (*P. ponderosa*) cone and seeds. No stratigraphic profile.								
TX-4024	1	V	200	6N22W	30	2	Charcoal/20.0	640±60	655±67
	Feature 2 (salvage) = earth oven = Feature 1 (testing). Sample includes Ponderosa pine charcoal, pine seed fragments, pine bark (all *P. ponderosa*) and Hawthorn (*Crataegus* sp.).								
TX-4025	4	II	380	4.77N .29W	112-120		Charcoal/20.6	3880±50	4395±106
	Sample collected from cutbank profile, not associated with any excavated cultural material.								

[1] TX samples were dated by University of Texas-Austin, Radiocarbon Laboratory.

[2] These dates have been converted to a half-life of 5730 years and dendrocorrected according to Damon et al. (1974).

Table A-2. Results of physical and chemical soil analyses, Column 1, 45-DO-204.

Sample No.	cm Below Surface	Physical Analyses									Chemical Analyses			
			Particle Size	Constituents										
		Munsell Color (dry)	Sand/Silt/Clay (%)	Charcoal (%)	Ash[1] (%)	Bone (%)	Shell (%)	Organic Matter (%)	Minerals (%)	Grain Rounding[2]	pH	Organic Matter (%)	Exchangeable Calcium (ppm)	Phosphate (ppm)
1	16- 26	10YR(5/3)	87/10/ 3	Trace	–	–	–	Trace	99+	1-2	7.50	–	3710	58.1
2	36- 46	10YR(5/3-6/3)	85/12/ 3	–	–	–	–	Trace	99+	2	7.55	–	3850	56.0
3	60- 70	10YR(6/3)	90/ 7/ 3	–	–	–	–	Trace	99+	1-2	7.70	–	3010	48.3
4	90-100	Salt/pepper	92/ 5/ 3	–	–	–	–	–	100	2	8.25	–	3920	48.3
5	124-134	Light grey, salt/pepper	92/ 3/ 5	–	–	–	–	–	100	1-2	9.05	–	3430	28.7
6	154-162	10YR(7/2)	82/13/ 5	–	–	–	–	–	100	2	8.85	–	3640	24.5
7	162-172	10YR(7/2)	87/10/ 3	–	–	–	–	–	100	2	8.90	–	3325	29.4
8	173-180	Salt/pepper	90/ 7/ 3	–	–	–	–	–	100	2	9.00	–	3430	32.9
9	180-188	10YR(7/1)	80/17/ 3	–	–	–	–	–	100	1-2	9.00	–	3920	25.2
10	190-200	Salt/pepper	80/17/ 3	Trace	–	–	–	–	99+	1-2	9.20	–	3430	38.5
11	204-218	10YR(7/2)	87/13/ 0	–	–	–	–	–	100	1-2	9.25	–	3430	37.8
12	218-231	Salt/pepper	90/ 7/ 3	–	–	–	–	–	100	1-4	9.30	–	3710	32.9
13	236-246	Salt/pepper	90/ 7/ 3	–	–	–	–	–	100	1-2	9.30	–	3920	30.1
14[3]	168-182	Salt/pepper	92/ 5/ 3	–	–	–	–	Trace	99+	2	9.15	–	3710	24.5
15[3]	182-198	Salt/pepper	75/12/13	–	–	–	–	–	100	2-4	9.55	–	3395	48.0
16[3]	222-228	10YR(7/2)	75/15/10	–	–	–	–	Trace	99+	2	9.65	–	3255	49.0
17[3]	225-230	10YR(7/2)	55/35/10	–	25	–	–	–	75	1-2	9.55	–	4025	14.7
18[3]	188-200	–	80/ 7/13	–	Trace	–	–	–	99+	2	9.65	–	3640	21.7
19[3]	22- 32	10YR(5/2)	72/15/13	1	–	Trace	–	1	98	2-4	8.70	–	2415	39.9
20[3]	48- 58	10YR(6/3-5/3)	70/15/15	Trace	–	–	–	Trace	98	1-2	8.75	–	2520	44.8
21[3]	60- 70	10YR(6/3)	77/10/13	Trace	–	–	–	Trace	99	1-4	8.80	–	3395	48.2
22[3]	166-176	10YR(7/2)	65/22/13	–	–	–	–	–	100	2-4	8.40	–	3850	11.2
23[3]	98-108	10YR(6/3-6/2)	73/17/10	–	–	–	–	Trace	99+	1-2	9.30	–	2870	45.5

[1] Mazama Ash
[2] 1=angular, 2=sub-angular, 3=rounded, 4=sub-rounded.
[3] Off Column

Table A-3. Results of physical and chemical soil analyses, Column 1A, 45-DO-204.

Sample No.	cm Below Surface	Physical Analyses									Chemical Analyses			
		Munsell Color (dry)	Particle Size	Constituents							pH	Organic Matter (%)	Exchangeable Calcium (ppm)	Phosphate (ppm)
			Sand/Silt/Clay (%)	Charcoal (%)	Ash[1] (%)	Bone (%)	Shell (%)	Organic Matter (%)	Minerals (%)	Grain Rounding[2]				
1A	50-62	10YR(4/2)	73/14/13	4	-	-	-	Trace	95+	2	8.60	Trace	2800	38.5
2A	62-72	10YR(6/3)	67/18/15	Trace	-	-	-	Trace	99	1-4	8.85	-	3675	46.2
3A	64-74	10YR(6/3)	73/14/13	Trace	-	Trace	-	Trace	99	1	8.50	Trace	2170	46.2
4A	76-88	Salt/pepper	85/ 7/ 8	-	-	-	-	Trace	99	1-2	9.15	-	2485	44.8

[1] Mazama Ash
[2] 1=angular, 2=sub-angular, 3=rounded, 4=sub-rounded.

Table A-4. Results of physical and chemical soil analyses, Column 2, 45-DO-204.

Sample No.	cm Below Surface	Physical Analyses									Chemical Analyses			
		Munsell Color (dry)	Particle Size	Constituents							pH	Organic Matter (%)	Exchangeable Calcium (ppm)	Phosphate (ppm)
			Sand/Silt/Clay (%)	Charcoal (%)	Ash[1] (%)	Bone (%)	Shell (%)	Organic Matter (%)	Minerals (%)	Grain Rounding[2]				
1	5- 12	10YR(4/3)	75/15/10	Trace	-	-	-	1	98+	2-4	8.40	Trace	2135	56.7
2	15- 22	10YR(5/3)	72/18/10	Trace	-	-	-	Trace	99	2-4	8.60	-	1925	56.7
3	26- 36	10YR(5/3)	75/17/ 8	-	-	-	-	Trace	99+	2-4	8.70	-	2135	59.5
4	46- 54	10YR(5/3-4/3)	75/15/10	Trace	Trace	-	-	Trace	98	2-4	8.70	-	2485	56.7
5	56- 58	10YR(5/3-6/3)	77/13/10	-	-	-	-	Trace	99+	2	8.65	-	2555	57.4
6	60- 66	10YR(6/3)	77/15/ 8	-	-	-	-	-	100	2-4	8.60	-	1925	49.7
7	67- 72	10YR(6/4)	80/10/10	-	-	-	-	-	100	2	8.70	-	1995	51.8
8	80- 90	10YR(6/3)	80/10/10	-	-	-	-	Trace	99+	2	8.95	-	2485	53.2
9	96- 98	10YR(6/3)	77/13/10	-	-	-	-	3	97	2	9.10	-	3010	53.2
10	99-101	Salt/pepper	92/ 0/ 8	-	-	-	-	Trace	99+	2-4	9.50	-	2380	31.5
11[3]	93- 98	10YR(7/3)	75/15/10	-	-	-	-	-	100	2	9.20	-	2205	52.5

[1] Mazama Ash
[2] 1=angular, 2=sub-angular, 3=rounded, 4=sub-rounded.
[3] Off column

Table A-5. Results of physical and chemical soil analyses, Column 3, 45-DO-204.

Sample No.	cm Below Surface	Physical Analyses										Chemical Analyses			
		Munsell Color (dry)	Particle Size	Constituents							pH	Organic Matter (%)	Exchangeable Calcium (ppm)	Phosphate (ppm)
			Sand/Silt/Clay (%)	Charcoal (%)	Ash[1] (%)	Bone (%)	Shell (%)	Organic Matter (%)	Minerals (%)	Grain Rounding[2]				
1	12- 26	10YR(5/2)	75/18/ 7	2	–	–	–	1	97	2	9.10	–	1596	42.0
2	38- 53	10YR(5/3)	80/15/ 5	2	–	–	–	1	97	1	8.40	–	847	46.2
3	67- 83	10YR(6/3)	75/18/ 7	2	10	–	–	Trace	87+	1	9.55	–	2366	52.5
4	90- 94	10YR(7/2)	75/20/ 5	3	5	–	–	Trace	91+	2-4	9.20	–	1470	48.9
5	100-113	10YR(7/2)	72/20/ 8	2	7	–	–	1	90	4	9.60	–	1960	47.6
6	120-132	10YR(7-8/2)	70/25/ 5	2	3	–	Trace	3	91+	1-2	10.00	–	4585	19.6
7	140-146	10YR(8/2)	70/20/10	Trace	4	–	Trace	Trace	95	2-4	10.00	–	2366	3.5
8	156-170	10YR(8/2)	72/20/ 8	–	5	–	–	Trace	94+	2-4	10.20	–	3514	10.5
9	180-190	10YR(7/3)	25/62/13	–	70	–	–	–	30	2	10.10	–	4186	25.9
10	185-195	10YR(8/2)	75/15/10	–	2	–	Trace	–	97+	4	10.50	–	2674	23.1
11[3]	198-210	10YR(6/3)	75/15/10	4	Trace	–	–	–	95+	2	10.50	–	2884	23.1

[1] Mazama Ash

[2] 1=angular, 2=sub-angular, 3=rounded, 4=sub-rounded.

[3] Off column

APPENDIX B

FAUNAL ASSEMBLAGE, 45-DO-204

Family Leporidae

Lepus cf. townsendii

Zone 2: 1 scapula fragment.

Zone 3: 1 ulna fragment.

Family Sciuridae

Marmota flaviventris

Zone 2: 2 humerus fragments, 1 radius fragment.

Zone 3: 1 astragalus fragment, 1 radius fragment.

Family Geomyidae

Thomomys talpoides

Zone 2: 1 humerus.

Zone 3: 1 mandible fragment.

Zone 4: 1 mandible, 4 mandible fragments, 1 maxilla fragment, 1 humerus, 1 scapula, 1 skull fragment.

Family Heteromyidae

Zone 1: 1 innominate, 1 mandible.

Zone 4: 2 femurs, 2 innominates, 1 mandible, 1 maxilla, 1 scapula, 2 tibias.

Family Cricetidae

Peromyscus maniculatus

Zone 1: 1 mandible.

Zone 4: 1 maxilla fragment.

Microtus spp.

Zone 2: 1 mandible, 1 maxilla fragment.

Zone 4: 1 maxilla fragment.

Lagurus curtatus

Zone 2: 1 mandible, 1 mandible fragment.

Zone 3: 1 maxilla fragment.

Zone 4: 3 mandibles, 1 maxilla fragment, 1 skull.

Family Mustelidae

Mustela frenata

Zone 2: 1 complete skeleton.

Family Cervidae

Odocoileus spp.

Zone 1: 2 carpals.

Zone 2: 1 M_3, 1 molar fragment.

Zone 3: 1 molar fragment.

Family Cervidae/Bovidae

Deer-sized

Zone 2: 1 atlas fragment, 1 mandible fragment, 1 lumbar vertebra fragment.

Family Hominidae

Homo sapiens

Zone 2: 1 second phalanx.

Zone 3: 1 ulna fragment.

Although no burials were encountered at 45-DO-204, human bones recovered from Zones 2 and 3 may indicate nearby burials disturbed by rodents or erosion. A second phalanx from level 10 in quad 3S6E is assigned to Zone 2. The only other materials in the level were two flakes and an unidentified bone fragment. The Zone 3 specimen is an ulna fragment found in level 60 of quad 1N4E. The loose sandy matrix of this level, directly overlying the basal cobble layer, contained seven other unidentified bone fragments. Neither piece of human bone was associated with staining, artifact or bone concentrations, or any indication of a pit.

Family Chelydridae

Chrysemys picta

Materials:

Zone 3: 5 shell fragments.

Family Ranidae/Bufonidae

Zone 4: 2 humeri, 2 radioulnas, 2 tibiofibulas.

APPENDIX C:

DESCRIPTION OF CONTENTS OF UNCIRCULATED APPENDICES

Detailed data from two different analyses are available in the form of hard copies of computer files with accompanying coding keys.

Functional analysis data include provenience (site, analytic zone, excavation unit and level, and feature number and level (if applicable); object master number; abbreviated functional object type; and coding that describes each tool on a given object. Data normally are displayed in alphanumeric order by site, analytic zone, functional object type, and master number. Different formats nay be available upon request depending upon research focus.

Faunal analysis data include provenience (site, analytic zone, excavation unit and level, feature number, and level (if applicable); taxonomy (family, genus, species); skeletal element; portion; side; sex; burning/butchering code; quantity; and age. Data normally are displayed in alphanumeric order by site, analytic zone, provenience, taxonomy, etc.

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